LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

[Trade-Mark Registered.]

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New Year's Greeting.

"Locomotive Engineering," herself celebrating her ninth birthday, sends greetings to all her readers at home and abroad.

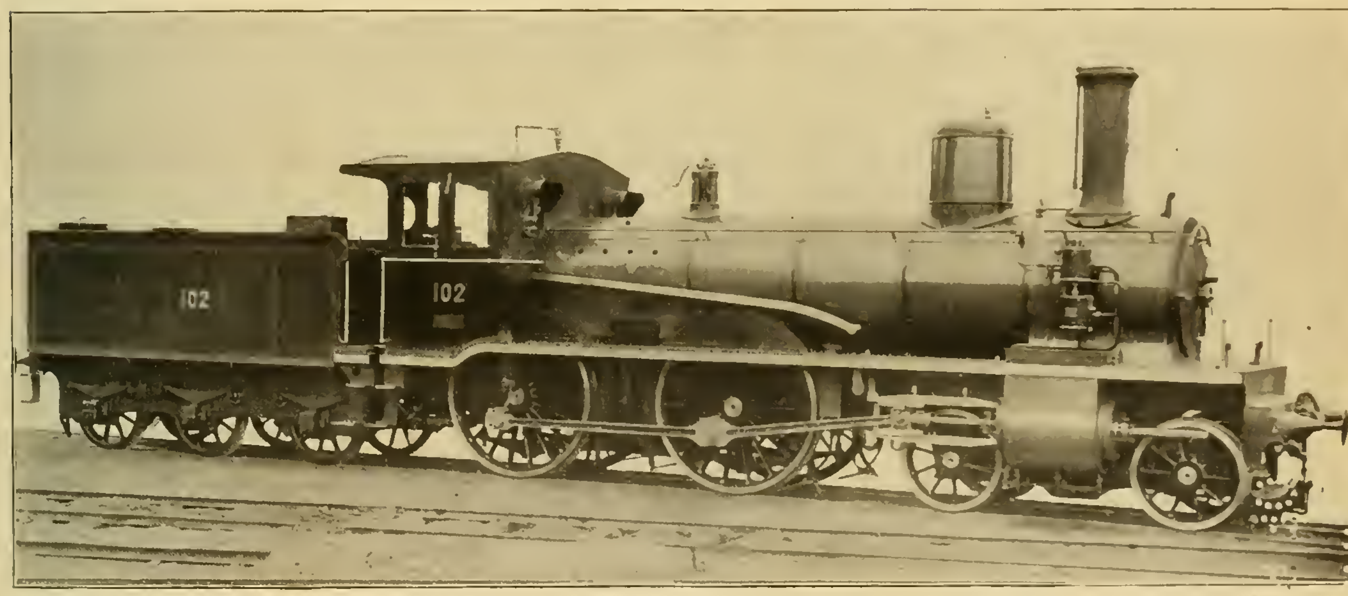
With this issue commences the tenth year. For the hearty support and co-operation of the thousands of readers and hundreds of advertisers in the past nine years we are thankful. Their support has made all our enterprises possible and successful.

For the future—well, we will make no promises; we believe in the motto, "Never tell what you are going to do—do it."

We believe we can make "Locomotive Engineering" better each succeeding issue, and intend to do so.

After a long depression, business is slowly but surely getting better. Better times on the railroads means better times to us, more opportunity and more means to push out and make this paper the ideal paper for railroad men in the mechanical departments—that's what we are living for. That's why we are having a "Happy New Year" ourselves and hoping all our readers will have the same.

SINCLAIR & HILL.



A MODERN EIGHT-WHEELER IN SWITZERLAND.

Misplaced Grease.

Our genial friend, Mr. William Gibson, erst-time superintendent of the Big Four, has gone to be assistant to the general manager of the Baltimore & Ohio. His numerous friends in Cincinnati banqueted him as a means of collectively dropping the farewell tear. The sentiment of the gathering may be inferred from the following extract from the chairman's address:

"We assembled here to-night to get a $10 dinner for $5 cash, and to bid God-speed to one of the best fellows it was ever my good fortune to know. I was both glad and sorry when I learned that our friend, Billy Gibson (for we always call you 'Billy'—even after you become president of the B. & O. system), was going to leave us—glad that he was going to fill a more exalted position, and sorry to lose one of the very few men whose friendship I really cherish.

"When I heard of his intentions someone asked me why he had made up his mind to go. I replied that it reminded me of a story I once heard of an old gentleman who, before getting into an express train at a London station, gave the conductor a shilling and said: 'I wish you would make sure of catching the 11:45 at Crewe.'

"The conductor went to the engine driver, who had been a witness of the tipping business, and said:

"''Ere, Billy, this 'ere gentleman wants to catch the 11:45 at Crewe.'

"They arrived there just in time to see the 11:45 leaving the station.

"The old gentleman went in a rage to the engineer and shouted: 'Weren't you told to catch the 11:45?'

"The impassive engineer, with a solemn wink, replied: 'Yes, sir; but you greased the wrong end of the train.'"

* * *

We notice a growing tendency among those who contribute papers to engineering societies to give metric measurements of articles described. We wish to suggest to these people that the recognized system of measurement among American engineers and mechanics is based on the foot or inch, and that standard is not likely to be changed as long as time lasts. The practice of giving measurements according to the metric system is in most cases a piece of snobbishness which ought to be snubbed.

Photographing Railway Trains at Full Speed.

BY F. W. BLAUVELT.

Although photographs have frequently been taken of swiftly moving trains, it is an operation verging very closely on the brink of an impossibility, because, to make it successful, so many favorable conditions are necessary at the same instant; one of the first difficulties is to get a proper focus without the sitter (the train) being present, and this is followed by many others too numerous to mention.

The surprising part of this operation is, that with the very quick exposure necessary to overcome the motion of the train, enough light can be transmitted through the lens to cause the chemical action on the plate necessary to leave the image of the train and the surrounding scene upon it.

The exposure on the plates from which the four photos herewith were made was only $\frac{1}{150}$ of a second, which was none too quick, for even in that very small fraction of time a train running 60 miles an hour moves about 8 inches, at 55 miles an hour about 7½ inches and at 53 miles an hour about 7 inches, so that they cannot be successfully taken broadside, and if it were not possible to use a long focus lens which makes a fairly good-sized picture a considerable distance from the object, it is doubtful if an exposure of $\frac{1}{150}$ of a second would be quick enough to overcome the motion sufficiently to leave as little blur from it as there is in these pictures, even when taken nearly head on.

The rate of speed given with these photos is only intended to show as nearly as possible how fast each train was running at the time it was photographed. That of the "Empire State Express" was fixed by the engineer of that train; the others were estimated by myself, by timing them by the watch for a certain distance, as they approached me; this I was enabled to do quite accurately, being perfectly familiar with the localities where the pictures were taken, which were on long stretches of straight track, where I could see the trains coming for a mile or more.

The "Empire State Express" runs from New York City to Buffalo, N. Y., 440 miles in 8 hours and 15 minutes (495 minutes), while its rival, the "Black Diamond Express," covers the same distance between the same points in 9 hours and 55 minutes (595 minutes); this train has very heavy grades to climb which accounts for the extra time used. The "Royal Blue Line, Limited," runs from New York City to Washington, D. C., 227 miles in 5 hours (300 minutes) and the "Pennsylvania Limited" runs from New York City to Chicago, Ill., 988 miles in 24 hours (1,440 minutes); this train also has very heavy mountain climbing to do. Of course, on all these runs there are several changes of engines, some regular stops and ordinary detentions which have to be covered in the time given, and as the three last-mentioned trains start from Jersey City, N. J., a deduction of from 12 to 15 minutes should also be made from their running time, for the time used in crossing by ferryboat (1 mile) from New York to and getting away from Jersey City, the schedules all being from New York to various points of destination.

The engines shown in these pictures not emitting smoke, burn anthracite or hard coal, from which there is none.

Graphic History of the Locomotive.

We present herewith Chart No. 1 of the twelve we propose to use during 1897 to show up the history of the locomotive at a glance.

To Sir Isaac Newton, in 1680, belongs the credit of first suggesting the use of steam for propelling a wheeled vehicle. His plan was simply to mount an enlarged "Hero" engine on wheels. "Hero" of Alexandria invented the engine using a jet of steam against the pressure of the atmosphere centuries before.

Leaving out all the suggestions, models and experiments of mechanics who tried to build locomotives for common roads, and coming down to railroads, we find that the first locomotive that ever did any actual work on a railroad was the one shown in the upper right-hand corner of our chart, marked "1803," the date of its construction. This locomotive was designed and built by Richard Threvithick and employed on the Merthyr Tydvil tramway, in South Wales. This engine hauled ten tons of iron and nine persons on her trial trip. The boiler was filled with water at the start, and no more put in. She could run five miles per hour, but used, as a regular thing, four hours to go nine miles. This engine had 3-foot wheels, the boiler being 4 feet 3 inches in diameter and 6 feet long. The single cylinder had a bore of 8¼ inches and a stroke of 4 feet 6 inches. Not much of a locomotive, but the grandfather of them all.

In the lower left-hand corner of the chart is shown a good picture of the "Puffing Billy," the first successful locomotive employing smooth driving wheels and discarding gears, teeth and other means for increasing the driving power. This engine was built in 1813, by William Hedley, at Wylam, near Newcastle, England. This engine did the work of ten horses on the Wylam tram line in hauling coal. Speed, 5 miles per hour; steam pressure, 50 pounds. The exhaust entered a small drum on top of boiler, and from there to the stack; this was to prevent noise. This engine is still preserved in the South Kensington Museum, in England.

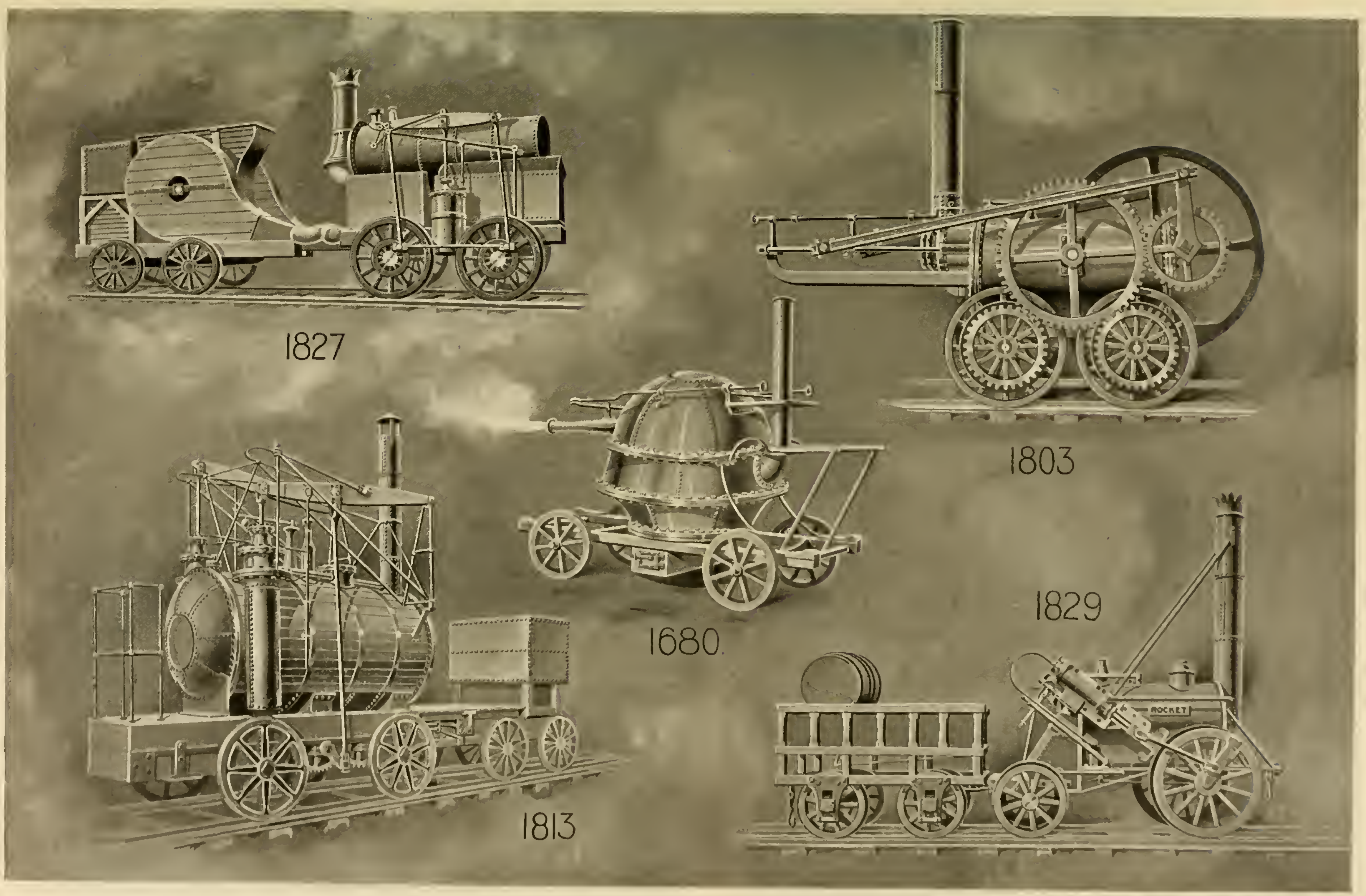
In the upper left-hand corner of our chart is a picture of the first locomotive with flues—a multi-tubular boiler. This engine was originally built by George Stephenson, in England, and sent to the first railroad in France—the St. Etienne & Lyons. The chief engineer of the road, Marc Seguin, experimented with the boiler, taking out the old single flue and firebox combined, and putting in a number of small tubes, using a brick firebox and designing a cylinder arrangement of his own.

In the lower right-hand corner of our chart is a picture of the famous "Rocket," the winner at the Rainhill trials on the Liverpool & Manchester Railway, in 1829. She was built by George Stephenson at Newcastle, and had many new features not before employed. She was the first to have a rectangular firebox surrounded by water; this was of the form afterward known in this country as the "fantail." There were twenty-five copper tubes 3 inches in diameter. The barrel of the boiler was 6 feet 3 inches long and had ample steam space, the tubes all being below the center line. This engine weighed 4½ tons and at the trial ran 30 miles per hour, opening up a new field for steam locomotives. The main features employed in the "Rocket" have lived until now; the principle of the boiler is the same, and the exhaust was in the stack. So famous has this engine become in history that many believe she was the first locomotive built. As a matter of fact, nearly a hundred locomotives had been built before the "Rocket;" her builder used the best ideas of other engineers, and thus made a world-beater.

There will be a chart each month, coming nearer and nearer in date to our own time.

The Rogers Locomotive Works are busy building several new boilers, the greatest number of which are of the Belpaire type. Two boilers just completed are for the Oroya Railway of Peru. They were constructed to replace some boilers on locomotives built at these works twenty-six years ago, and are of the kind known as the "Milholland." They are expected to fit into the frames of the engines to which the old and scrapped boilers belonged. A good-sized and interesting homily on the value of a properly equipped and managed drawing office is written in unmistakable language in the construction of these two boilers from the same drawings of 26 years before; they furnish the best of evidence that thorough work was done at that time, and that proper care was taken of the drawings, otherwise perfect duplicates of those old boilers never would have been possible. This is a good object-lesson to the few who still cling to the idea that a drawing office is a luxury, and prefer to carry details around in their hats.

"The infirmary road" is the term used by Scotch railway men for the track set apart for storing disabled cars.



1827. Marc Seguin. First to use Multi-Tubular Boiler.

1813. Wm. Hedley. First successful adhesion locomotive, the "Puffing Billy."

GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 1.

1680. Sir Isaac Newton. First suggestion of a steam-moved vehicle.

1803. Richard Threvithick First locomotive in the world to do actual work

1829. Geo. Stephenson. First rectangular firebox with small flues, "The Rocket."

"EMPIRE STATE EXPRESS," AT THE SPEED OF 60 MILES AN HOUR.
The fastest regular train in the world—N. Y. C. & H. R. R. R.

BLACK DIAMOND EXPRESS," AT THE SPEED OF 55 MILES AN HOUR.
Lehigh Valley R. R.

A GLIMPSE OF FOUR POPULAR AND FAST

From Photographs (Copyright, 1896)

"PENNSYLVANIA LIMITED," AT THE SPEED OF 53 MILES AN HOUR.
Pennsylvania R. R.

"ROYAL BLUE LINE LIMITED," AT THE SPEED OF 55 MILES AN HOUR
B. & O., P. & R. and C. R. R. of N. J. Railroads.

AMERICAN RAILWAY TRAINS AT FULL SPEED.
by P. W. Blauvelt, New York.

Passenger Locomotive for the Illinois Central Railroad.

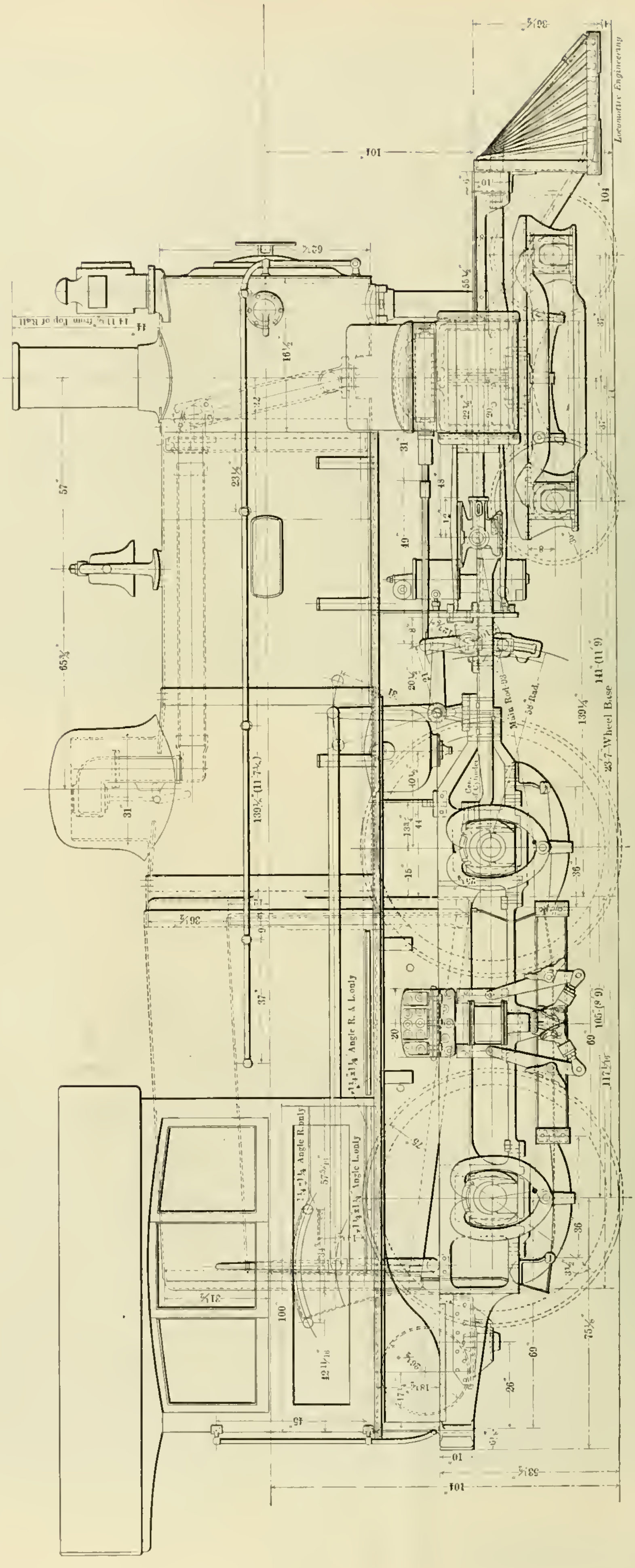
A new passenger engine representing what is considered by the builders to closely approach the highest development of the eight-wheeled type, is just out of the shops of the Brooks Locomotive Works. It embodies some innovations, as would be expected in a machine for which advanced practice was claimed, among which are the location of the air pump under the waist of the boiler, between the motion plate and cylinder saddle. The sandbox is also under the waist, located just back of the reverse shaft and forward of the main driving axle.

The pops and whistle are made to extend from a small dome of their own situated in the cab, up through the roof of same, and are cased in. With nothing visible on the boiler but the bell and sandbox, the machine looks extremely plain, but handsome withal and businesslike, as will be seen by the half-tone engraving.

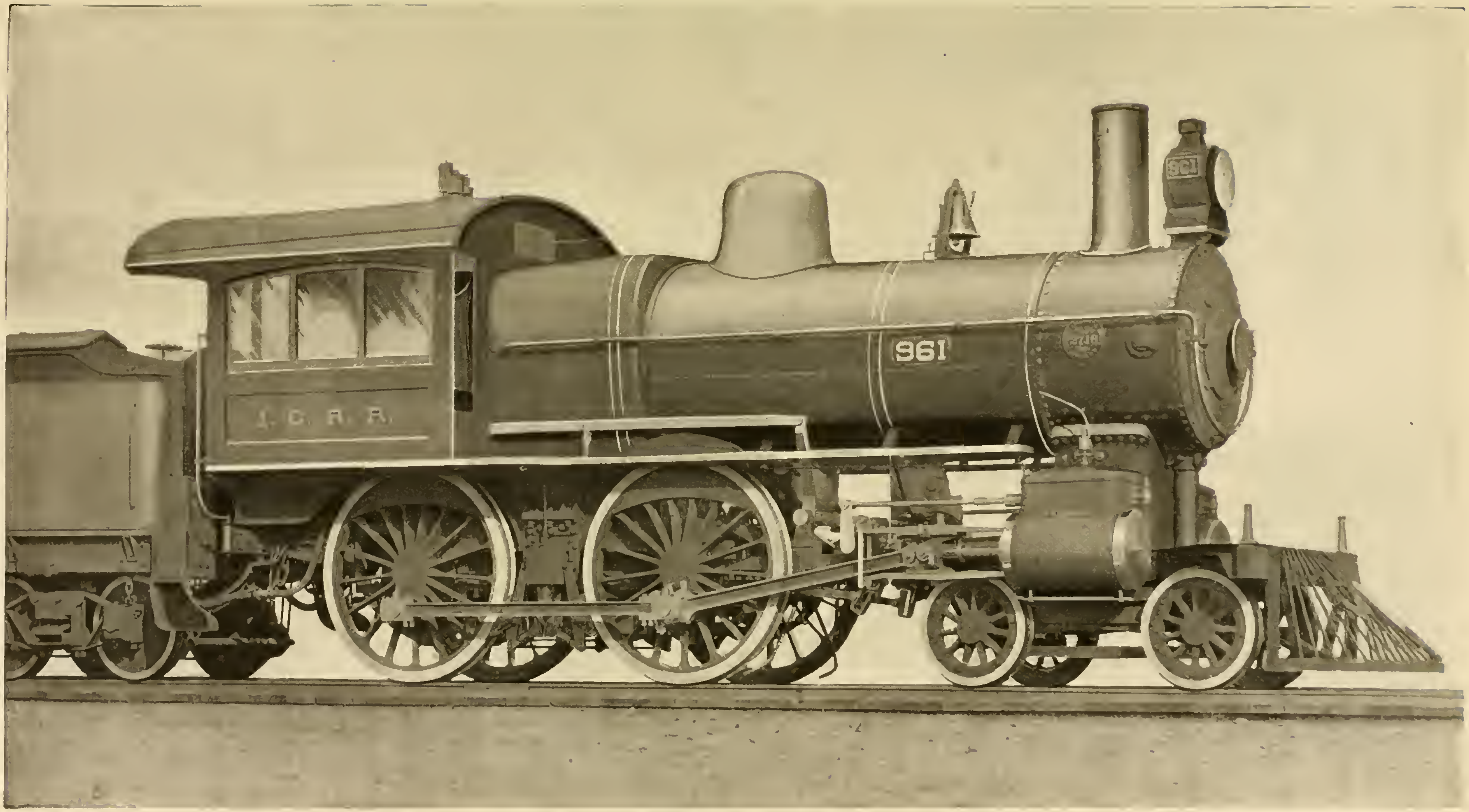
Particular attention has been given to the matter of comfort and convenience of the engineer and fireman, by means of drop sliding seats, that a man don't have to climb into and out of. The injectors are both on the right-hand side. There is a flush deck for the fireman, from the cab floor to the coal space in the tank. There are steps and handholds to get into the cab, that are safe, easy to climb, and worthy of the name. With these brief notations of some of the prominent features, we present some working elevations of this engine that will be interesting, in which will be seen the slab frame 1⅝ x 10 inches between the drivers, by which means a wider firebox was obtained, the lower section of frame being of the regulation bar type. The method of connecting the underhung spring to the top of the driving boxes, instead of the bottom, is also clearly shown, among the other details.

Steel has been largely used in the construction of this engine; this material is found in the wheels, crossheads, pistons, cylinder heads and steam chests, the object being to keep down the weight. Below is a description of the engine:

Type—Eight-wheeled passenger.
Simple or compound—Simple.
Gage—4 feet 8½ inches.
Fuel—Bituminous coal.
Steam pressure—200 pounds.
Diameter of cylinders—18 inches.
Stroke—26 inches.
Wheel-base of engine—23 feet 7 inches.
Driving-wheel base—8 feet 9 inches.
Total wheel-base of engine and tender—50 feet 6 inches.
Driving-wheels, diameter over tire—75 inches.
Driving wheels, diameter over centers—68 inches.
Driving-wheel centers—Cast steel.
Driving-wheel tires—Krupp crucible steel.



ELEVATION, ILLINOIS CENTRAL PASSENGER LOCOMOTIVE.



Designed by W. Renshaw, Supt. Machinery, Illinois Central Railroad.

ILLINOIS CENTRAL PASSENGER LOCOMOTIVE.

Built by Brooks Locomotive Works, Dunkirk, N. Y.

Engine-truck wheels, diameter—36 inches.

Weight under drivers—80,000 pounds.

Weight under engine truck—40,000 pounds.

Weight of tender, loaded—88,000 pounds.

Weight of engine and tender, total—208,000 pounds.

Tractive power, at 90 per cent. B. P., minus 10 per cent. for friction—18,190 pounds.

Co-efficient of adhesion—4.4.

BOILER.

Type—Patent improved Belpaire wagon top with conical connection.

Material—Steel.

Tubes—Diameter, 2 inches; length, 11 feet 7 inches.

Tubes, number—274, No. 12, B. W. G.

Heating surface, tubes—1,649.4 square feet.

Heating surface, firebox—152.2 square feet.

Total heating surface—1,801.6 square feet.

Grates—Shaking, fingerbars.

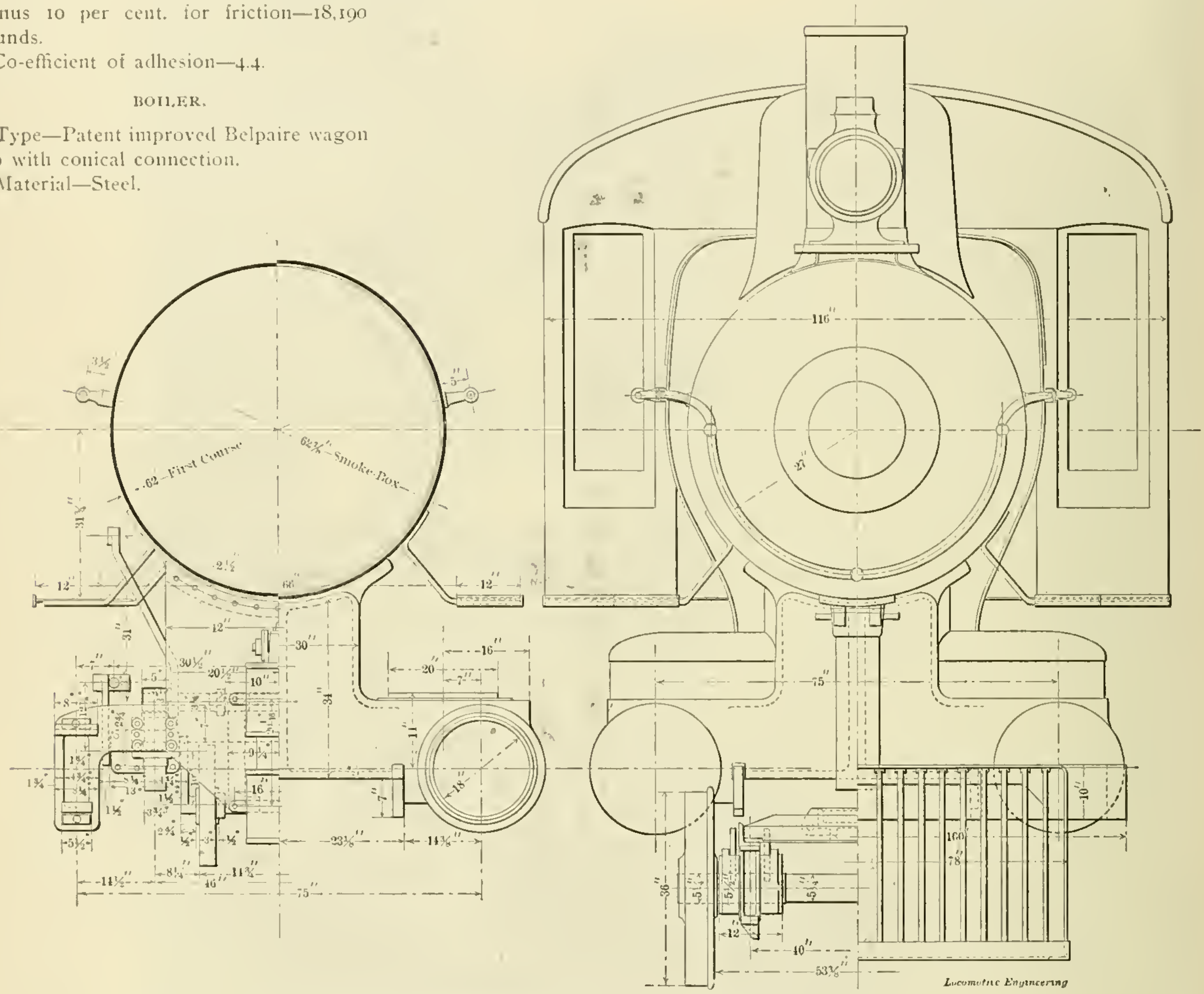
Lubrication, guides—Adjustable needle cups.

Lubrication, rods—Spindle feed, cups forged on.

Lubrication, cylinders—No. 9 old style Nathan, and oil cups on steam chest.

Injectors—One No. 9 Monitor, and one No. 8 Ohio.

Safety valve—Two 3-inch Ashton pops (one open and one muffled).



DETAILS OF CONSTRUCTION, ILLINOIS CENTRAL LOCOMOTIVE.

Diameter at smallest ring—62 inches outside.

Thickness of cylindrical plates, waist—9-16, 5/8, 1/2 and 7-16 inches.

Thickness of throat sheet—5/8 inch.

Longitudinal seams, kind—Quintuple riveted.

Vertical seams, kind—Double riveted.

Firebox, kind—Sloping between frames.

Firebox, length inside—107 5/8 inches.

Firebox, width inside—36 3/8 inches.

Firebox, material—Steel.

Firebox, side sheets, thickness—5-16 inch.

Firebox, back sheet, thickness—3/8 inch.

Crown sheet, thickness—3/8 inch.

Tube sheets, thickness—Front, 5/8 inch; back, 1/2 inch.

Water spaces, width—3 1/2 inches sides, 4 inches front and back.

MACHINERY.

Piston-rods, kind—Ewald C. C. bloom iron.

Piston-rods, diameter—3 1/2 inches.

Piston-rod and valve stem packing—United States metallic.

Piston packing—Dunbar.

Crosshead—Alligator type, cast steel.

Driving axles, kind—Hammered iron.

Driving axle journals—8 1/2 inches diameter, 11 inches long.

Engine truck axles, kind—Hammered iron.

Engine truck journals—5 1/2 inches diameter, 12 inches long.

Connecting-rods—I-section, hammered iron.

Side-rods—I-section, hammered iron.

Valves, kind—Allen, American balanced.

Whistle—B. L. W. 6-inch chime.

Brakes, train—Westinghouse automatic on all tender wheels.

Brakes, driver—Westinghouse, with push pistons.

Train signal—Westinghouse, Schedule J.

TENDER.

Frame, kind—Oak.

Truck, kind—Two, four-wheeled.

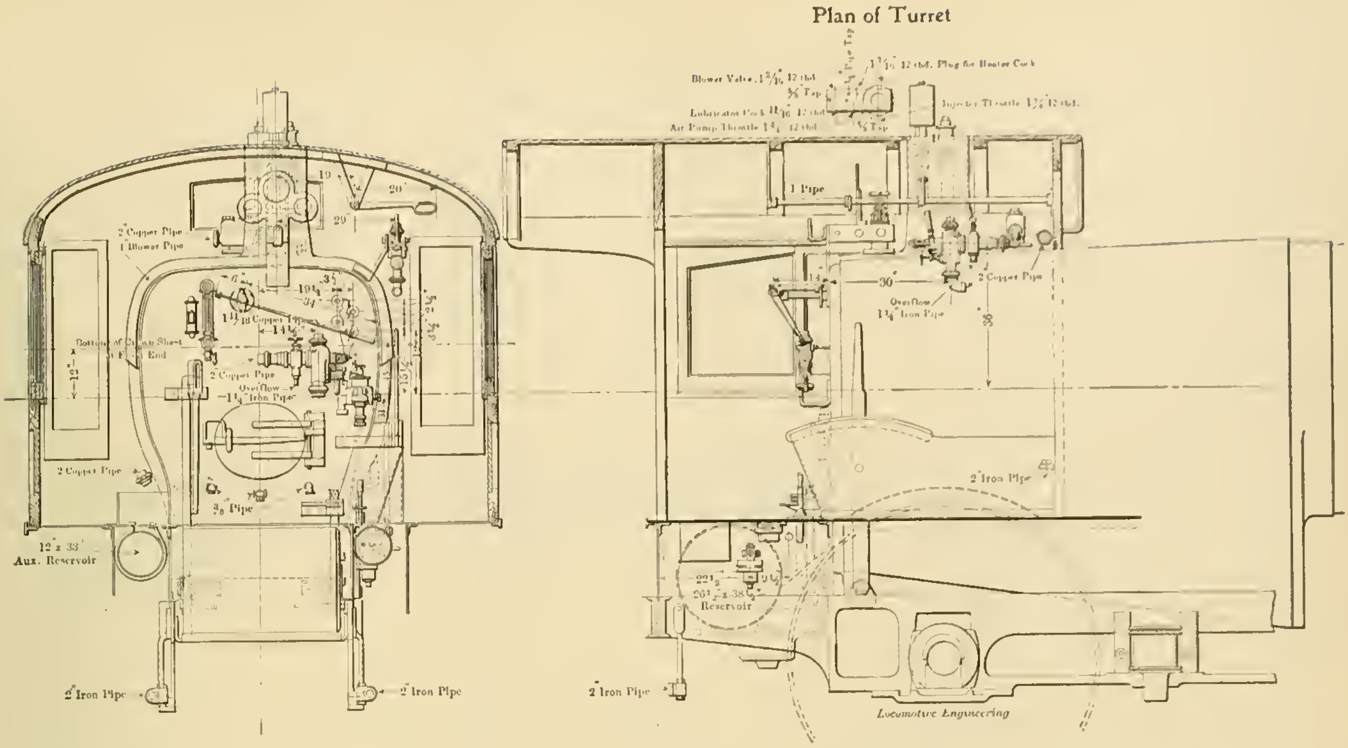
Wheels, diameter—38 inches.

Truck axles—Hammered iron.

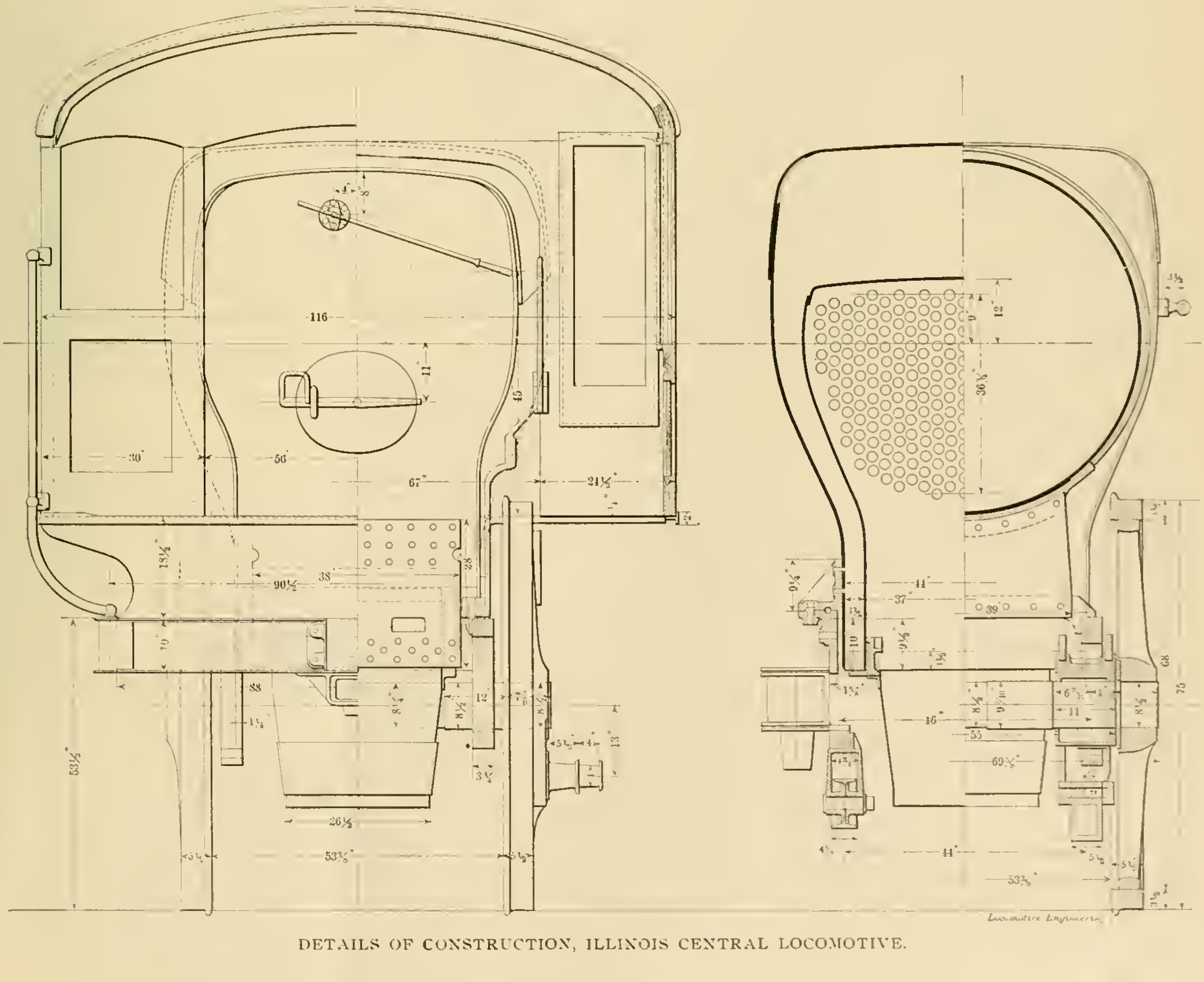
Truck axle journals—4 1/4 inches diameter, 8 inches long, M. C. B. standard.

Capacity for water—4,200 United States gallons.

Get a computer. It figures tractive power without mistakes.



DETAILS OF CONSTRUCTION, ILLINOIS CENTRAL LOCOMOTIVE.



DETAILS OF CONSTRUCTION, ILLINOIS CENTRAL LOCOMOTIVE.

Staybolt Threading and Stripping Device.

Master Mechanic J. N. Weaver, of the Lehigh Valley Railroad, at Sayre, Pa., has built and in operation at his shops, a machine for threading staybolts and also removing the thread to an amount equal to a little more than its depth and for any required length, at one setting of the work in the machine; the depth being regulated by the diameter of bolt, and the length of the stripped portion by the width of the water space through which the bolt passes; that is, nearly all the thread is removed except that portion required to make a fit in the sheets.

In our illustration of this ingenious arrangement, Fig. 1 shows the die holder and stripper block as used on the machine, which, by the way, was improvised from an old drill press, on which is shown the air cylinder in connection with the spindle, and which is used for starting the bolts in the dies, besides raising the spindle when necessary to introduce a new bolt for cutting. In this view is seen the screw that operates the stripping cutters, at the end of which are seen the micrometer graduations on the edge of the disk. These marks show at once to the operator, at what point to set stripping cutters for a given sized bolt being threaded. Without this index it would be impossible to advance the cutters the correct distance, or to set them twice in the same place.

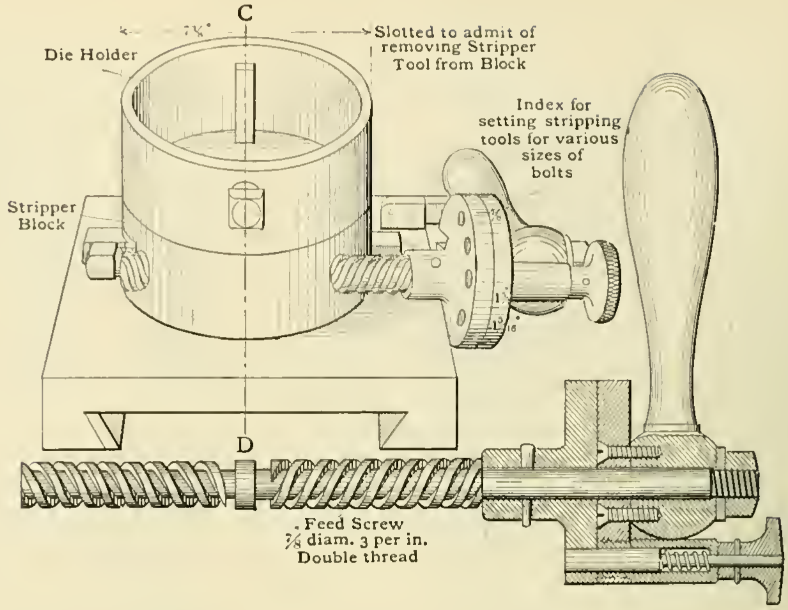


Fig. 1

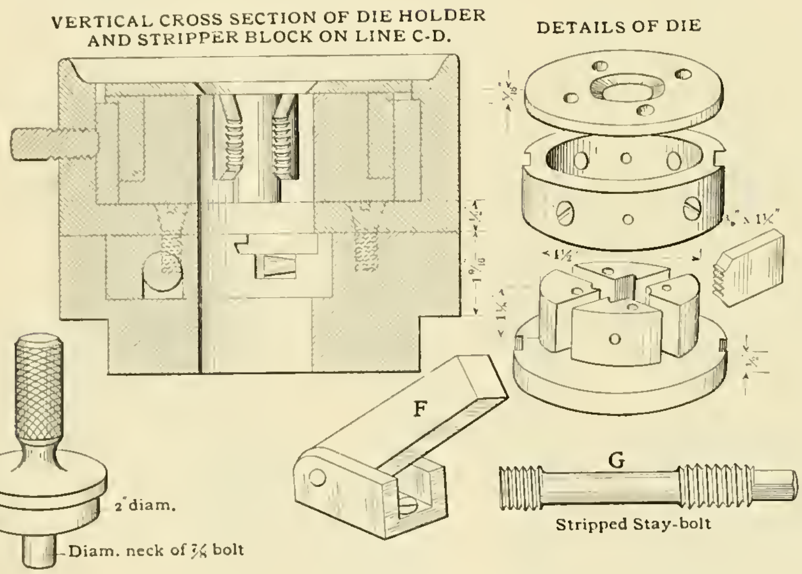


Fig. 2

Fig. 2 shows a vertical cross-section of the die holders and stripping block on line *C D* of Fig. 1, and also details of the die. At *E* is shown the plug fitting the hole of die holder, and this is used for setting the stripping cutters to the size of neck required for a ⅞-inch bolt. *F* shows the stop for the engaging lever, which is hinged to throw out when the feed screw is to be given more than one turn. *G* shows the finished staybolt with thread cut and reduced.

Fig. 3 shows a horizontal section of the stripper block on line *A B* of the elevation immediately above it. A plan of the die holder is shown at *H*, and the tool-head at *I*. The feed screw thrust block and the tool-locking dog and wedge are shown at *J* and *K*, respectively. The section makes it plain how the stripping cutters are advanced against the bolt by the right and left hand screw, and how they are locked in position by *K*.

We are indebted for the sketches from which our illustrations were made to Mr. W. G. Thomas, foreman of the tool-room at Sayre (who built the tool described), and present them to our readers just as they came from his pencil. For freehand work they will be conceded to be beautiful specimens of the art, showing a correct knowledge of perspective and shading that is only possessed by the most gifted artists.

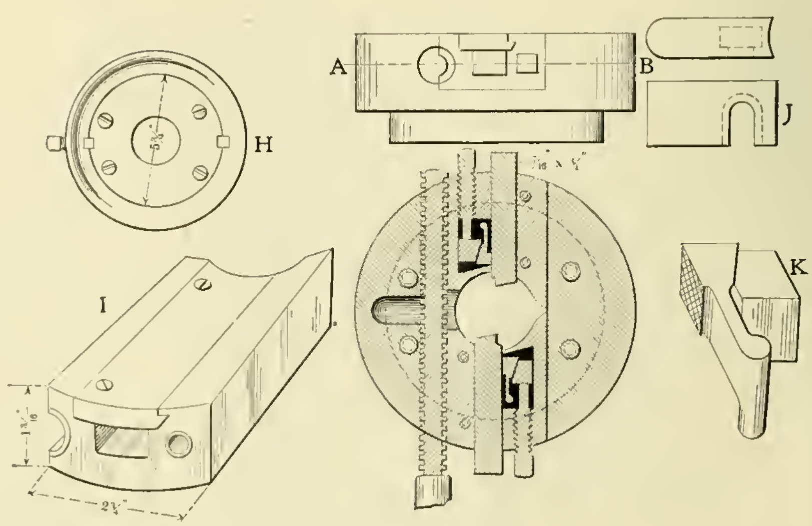
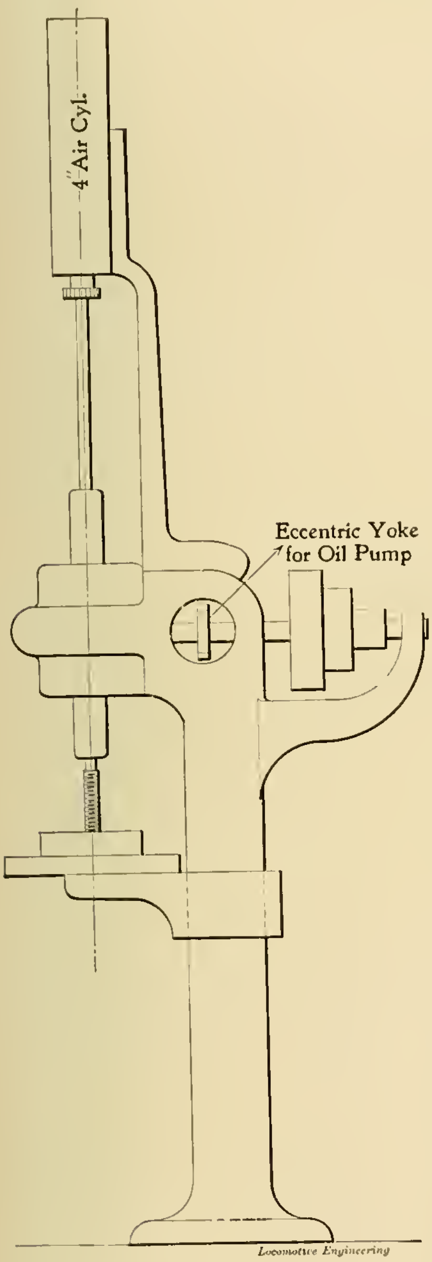


Fig. 3

The New General Manager.

BY ROGER V. HOOK.

It was a very odd thing, all the way through; probably nothing else like it ever occurred. The fact of men raising themselves by the force of their ability from the lowest ranks in railroad service to the highest position possible in that service, has more than once been accomplished; but sudden elevation from locomotive engineer to general manager was unheard of, and that was the cause of all the talk along the line of the First division of the L. & Western R. R., when rumors were circulated that Engineer George Granger was to be general manager of the L. & Northern.



STAY-BOLT THREADER AND STRIPPER.

The Western was a big trunk line, and had some two hundred and odd engines in service on the First division alone; the Northern was a suburban road, some half a hundred miles long and running only a score of so of engines; yet had the rumors said that Granger was to be made General Manager of the Great Pennsylvania system, the excitement could have been no greater, and his popularity increased at a remarkably rapid rate as the rumors gradually took the appearance of actual fact.

There were skeptics, of course, who argued somewhat in this manner: "There are brains enough among engineers to fill any position in railroad service and engineers have climbed up the ladder to the general manager's rung, 'way up top. But they don't make it in one jump, and if they did, why should Granger be picked out? Now, he's a good fellow and a good man with an engine; but he's never given evidence of special ability, nor distinguished himself above the rest of us, even if he has had the wreckers and special work for years. Blamed if I can see through it!"

Then these skeptics would try, very very quietly, to sift the rumors and get at the truth; but while positive facts were unobtainable, it was certainly in the air and accepted as a fact.

Granger was an engineer of long and good standing on the Western. For many years he had run the "77" on specials and wreck train; a kind of special job which is no longer common. And the "77" was no common engine, having been built in the company's shop, apparently by "rule of thumb." She had many peculiarities of her own; one of them being a sort of double-deck crown sheet which ran back for a couple of feet horizontally from the flue sheet, then dropped vertically for nearly a foot, then continued back horizontally again. The dome was placed over this elevated part of the crown sheet and well forward of the cab, so that in appearance she was something like a modern engine with radial-stayed boiler and extended wagon top; but she was light and slippery, and the corners of the crown sheet developed leaks that were chronic, and no extra man ever tackled the "77" without condemning her in language that was forceful enough, if not commendatory in other particulars.

The "77" was Granger's ideal engine, however, and he was fond of boasting of what he could do with her—how far he could run with one oiling, with one tank of water, the time he could make, and so on—for what pertained to Granger was by him always considered a little bit better than the best of anyone else's. And that was where his undoing started.

Granger had married the only daughter of a man considered well-to-do, and had come to consider that he was a little higher in the social scale than his fellows on the road. He had a son, George, Jr., and a daughter, Mary; the latter of the age when a change of name and permanent departure from the parental protection might naturally be expected at any time, and a bright, attractive girl with many admirers.

The most ardent of her admirers, and the one most favored by Mary, was Fred Sand, a yard brakeman on the same road. Sand was a clean, intelligent young man (he made a successful engineer of himself four or five years later); but he was only "following the engine" in the yard, not even a drill conductor, and Granger, who felt that he belonged to the very select one hundred and fifty in railroad society, did all that any man could do to turn the course of true love, but without success. As time passed, Fred rose higher in Mary's estimation, and all the mandates of Papa Granger failed to prevent these two from getting together and improving the limited opportunities they had, until it was quite commonly understood that Fred would marry Mary Granger. In fact, Fred had successfully passed the turning-point of love's fever, and the only qualification to Mary's "Yes" was that Fred should secure papa's consent. Knowing papa's ideas very well, Fred tried to get this qualification removed; but Mary was obdurate, and would not listen to Fred's arguments in favor of slipping quietly away to some clergyman first and getting papa's consent afterwards; so Fred tackled his prospective father-in-law with determination and self-possession. He anticipated Granger's reply, so perhaps went at it differently from the way he might have done under more favorable circumstances.

"George," he said abruptly, "I suppose you know I have been going to see Mary, off and on, for a good while?"

"Yes," said Granger, shortly.

"Well, she loves me and I love her. I can take care of her and make a good man for her, and she's willing. Are you?"

"Well, by——, I ain't," howled Granger. "If Mary hasn't got more sense than to throw herself away on a common switchman, I've got too much sense to let her. No, sir; you can't have her, and I want you to keep away from her."

If Sand had expected a different reception, there's no telling what might have happened at this; but it was just what he had looked for, what he had been prepared for, and he merely flushed a little as he replied: "Very well, Mr. Granger. I give you credit for your self-respect, and I didn't think you would consent to having Mary tied up to a poor devil of a switchman like me, but I couldn't help asking you because I love her so. I've always looked up to you and admired you, and it has been my ambition to get up to your position in the world, and I felt that it was outrageous to even ask you for your daughter. Please excuse me?" he asked humbly.

Granger stared at him in surprise, but said nothing, and Fred continued: "I have nothing against you for your refusal, Mr. Granger; nothing in the world. And I'll prove it to you before long. If my humble help can put you in a position that your abilities entitle you to, perhaps you may look upon me with more favor."

"What do you mean?" demanded Granger.

"I can't tell you yet," said Sand, "but I will soon. You know that a mouse helped a lion out of a hole once, and I'll surprise you yet. You must remember that many a man that doesn't amount to much himself has big, powerful friends," and he walked away, leaving Granger in a mollified but perplexed frame of mind.

Fred Sand had left Mary, the evening before his interview with her father, with an angry burning at his heart. He knew he could never persuade her to marry him against her father's wishes, and he knew exactly how her father would receive his request. A feeling of bitter resentment had taken possession of him; and, whether in a desire for revenge or as a means to secure Granger's consent, he had hit upon a remarkable scheme which had kept him awake all the night before, and which was upon his mind all the while he had been talking with Granger.

A few days later he met Granger again. The latter wasn't quite sure whether to be friendly or "offish." He was still puzzled over the hints Sand had thrown out, and was wondering what he had meant by referring to powerful friends, and wherein his connection lay with them. His curiosity had led him to be more civil than usual with Sand, and to wink at a couple of calls the latter had made upon Mary in the meanwhile, although the embargo was still nominally in force.

"Mr. Granger," said Fred (he had stopped using the familiar "George"), "I hinted something the other day which I have not forgotten, if you have."

"I hadn't thought much more about it," said Granger.

"Well, I have," said Sand, "and I'll have more to say to you, if I can bring things around as I want to. I have two or three good friends, if I am only a switchman, and I'll surprise you yet. You know the Northern road?"

"I know of it," replied Granger.

"Well, the general manager there doesn't fill the bill, and he's going to be allowed to resign pretty soon. It pays five thousand a year. Nice job, eh? Better than running the '77' or anything else on a road where merit like yours isn't recognized. Ever hear of Chauncey P. Green?"

"No," said Granger.

"Well, he's vice-president of the Northern and the heaviest stockholder in the road. He's a self-made man. Me and him—well, I wont tell you any more now; I'll wait a day or two until I have something definite."

Granger *invited* Sand to "come around to the house to-night," and after Sand left him, went down to the master mechanic's office and borrowed the "List of Railroad Officials" from the chief clerk. In the list of officers of the L. & Northern he found "Chauncey P. Green, V. P." When Sand called at Granger's house that night he was warmly received, and before he left, Granger managed to have quite a talk with him, by themselves, in which Sand carelessly dropped the information that Chauncey P. Green had been a poor boy and a schoolmate of Sand's; that Sand had rescued young Green from drowning, and that Green had never forgotten it, and now, since he had turned a small fortune, left him by an uncle, into millions by lucky speculations, he still thought as much of Sand as ever. "No airs about him, if he is a millionaire."

Granger pondered a few moments and then asked, suspiciously: "Why don't you get a good place from him?"

"Say," replied Sand, "I could have anything I wanted, but I won't take a thing—not yet—not even a job firing. He's wanted to make me superintendent, but I know I'm not competent to fill the bill, and I told him I had a friend I could recommend, and I told him all about you. Then he told me about their general manager not giving satisfaction, and said that would be better for you, if I could convince him that you was all that I had said, and wanted to know if I would take superintendent if he made you general manager. I told him that would be different, and I wouldn't mind if he made you G. M., for you would help me out, and"——

Just then there came a terrific ring at the door bell, and Mary, who answered it, came into the room with a telegram. "The messenger said he was sent here from your boarding house," said she, smiling, as she handed the message to Sand. "I'll bet it's from Chaunce," said Fred, as he tore the envelope open and read the message with evident pleasure. "It's from him," he said. "Is the boy out there yet?"

"Yes," said Mary; "he said he called for an answer."

"Bring him in," said Fred. The boy came in and gave Fred a blank, upon which he wrote a long message. "There," he said, handing it to the boy; "that's paid at the other end."

"It's 'D. H.,'" said the boy, as he went out, while Fred picked up the message again and read it to Granger. "Listen to this," he said: "'Will have to drop our G. M. first of month sure. I want to see you about your friend at once. If I send my coach for you to-morrow night, can you come over? Answer at once; don't prepay.' It's marked 'D. H.,' too," said Fred, showing it to Granger, who stared open-mouthed at the signature, "Chauncey P. Green," and could see nothing else, and who didn't know that it cost Fred a dollar to get that message fixed up and delivered. The next day Granger was very respectful in his manner to Sand, and in the afternoon he noticed that Sand was not at work. Granger was just eating supper that evening, when a stylish turnout stopped in front of the house. It was a handsome coach, drawn by two high-stepping horses; a coachman and a footman, both handsomely liveried, on the box. The footman jumped down and opened the coach, and out popped Fred Sand, elaborately attired in full evening dress.

"Just thought I'd have them drive around this way," he said. "That's Chaunce's turn-out. He's got a lot of 'em, and I've had some nice rides with him. I don't like this kind of a rig to wear, but I have to over there. He'll take me to the opera to-night, and talk business in the box, between the acts. Then there'll be a good supper and champagne afterwards. But I must go and not keep him waiting. He's great for punctuality and always wants everything on time. I'll tell you all about it to-morrow night. Good-bye!" and Fred ran out, jumped into the coach, the footman closed the door, mounted the box, the coachman cracked his whip, and the high-spirited team whirled the coach away from Granger's astonished vision. And in the coach, Fred smoked cigars and communed softly to himself, with many smiles, until the coach drew up at a fashionable livery and boarding stable, several miles out, in a stylish suburb; but he did grit his teeth and make an occasional wry face as he dragged back to town in a horse-car and thought of the bill he had had to pay.

Next morning, Granger looked for Fred in the yard, but found one of the night men working in his place, and Sand didn't appear until noon.

"After the opera," he told Granger, "we had a swell supper at Port's, and then he made me go to his house with him to talk some more, and it was after two o'clock this morning before he'd let me go. He wanted me to stay all night; but I told him I had to be at work, and he says: 'That's right, always 'tend to business,' and sent me back in the coach again. He wants me to bring you over to Port's to meet him to-night at 8:30. We'll have supper there at his expense, and he'll make some arrangements with you that will surprise you. You'll have to get your dress suit on for that."

"I haven't got any dress suit,' said Granger.

"Then you'll have to hire one," said Sand. "Wouldn't never do to take dinner at Port's in the evening without a dress suit. I'll call about 7:30, so I can have a few minutes with Mary before we go"

"Oh—ah—yes, do!" said Granger, absently. "Fred, I—ah—you must—well, I've thought the matter over, and I guess Mary couldn't do better than to marry you after all. I was out of sorts the day you asked me, or I wouldn't have talked as I did."

"I knew something like that was the reason," said Fred, highly delighted, "and I thank you. When can we get married now? Next week?"

"Not so soon," said Granger. "Better

wait until we've both got better positions. It'll sound better in the papers."

Sand's jaw dropped, but he said: "That won't be until after the 1st—three weeks yet."

"Well, we couldn't get up a wedding any sooner and have it right and as it should be," replied Granger.

The next evening, Fred came in a livery hack. "Wouldn't do to go to Port's on foot or on horse-cars," he said, "and I can't afford a turn-out like I was in last night."

"You must let me pay for the rig," said Granger, as they drove away.

"No, sir; you can't spend a cent on this deal," said Fred, decidedly.

Arrived at Port's, they were promptly shown upstairs to one of the private dining rooms. The style of the place awed Granger very much, and he felt ill at ease in his hired dress suit. They found the table spread for three, but Mr. Chauncey P. Green was not in evidence. Fred looked at his watch; "It's 8:40 now," he said, "and I never knew Chaunce to be a moment late." Turning to the colored waiter, he asked: "Hasn't Mr. Green arrived yet?"

"No, sah," replied the waiter, "He don't come yet, sah."

"Something has kept him, or he would have been here before this," said Fred. "Hello!" he added, as a district messenger appeared. "What's this?" The messenger handed him a note inclosed in an envelope bearing Fred's name and ornamented with a crest. "Pshaw!" said Fred, as he opened it. "It's from Chaunce, and something has happened to detain him." After reading it, he added: "That's to bad. He's been summoned to attend a meeting of the I. B. & W. directors, and is very sorry he can't come. Says for me to go ahead and make the arrangements with you that he told me of last night, and let him know if you accept. He says for us to eat our dinner just the same, with his compliments, as he has arranged for it and it will be charged to him. Read it," handing it to Granger. Granger took it gingerly, but read it carefully, clear down to the signature, "Hastily yours, C. P. G.," and handed it back. "It's too bad," he said.

"Yes, I'm sorry," said Fred; "but it can't be helped. You see, Chaunce is a busy man. He is director in a dozen different roads and president of two or three, and I'll bet, if you start on the Northern as G. M., he'll have you G. M. of some big road before he quits. All I'm afraid of is that he'll kill himself with so much on his mind all the while. He looked tired last night."

"Well, what'll we do now? Go back?" asked Granger, dejectedly.

"Certainly not," said Fred. "We'll just stay and eat the dinner. You saw he said he'd pay for it. And he says for me to go ahead and tell you what he wants—he told me of it last night. All you've got to do is to eat your dinner, on Chaunce, of course, and say 'Yes' or 'No' to his proposition." And he ordered the waiter to serve the dinner at once, as Mr. Green would not come. Granger did not appear to relish the dinner thoroughly, but Fred certainly did—he had already paid for it all and was determined to get as near his money's worth as possible. He remained irresponsive to all of Granger's efforts to draw him out, saying: "Wait until the cigars come; Chaunce will never talk business until the cigars go around;" and when they had finished their coffee and the waiter had held a lighted match to the tip of Fred's perfecto, he leaned back in his chair luxuriously and with a sigh of contentment. "Now," said he, "I'll tell you what Chaunce said last night. He said that on my recommendation and as a friend of mine, he would offer you general manager of the Northern at five thousand a year to start with; so now all you've got to do is to say 'Yes' or 'No' and that's settled. The other fellow was requested to resign, and Chaunce has his resignation now, to take effect the 1st. He showed it to me. He's told all the other officials that you are to have the place; but on account of the other man's feelings he hasn't bulletined it yet, and won't until the last minute. Chaunce is very considerate that way. And he says that he's so dissatisfied with the way things are going there that he wants you to clean 'em all out—superintendent, assistant superintendent, master mechanic, trainmaster, train dispatchers, all of 'em, and put your men in. Says he wants you to be successful, and that's the best way, for you to pick out your own staff."

"I'll accept, certainly," said Granger, eagerly, "and I'll make you superintendent, Fred. It won't look bad, will it, to see a notice on the bulletin, 'Frederick Sand is appointed Superintendent of the L. & N. R. R., *vice* so-and-so, resigned, to take effect at once. He will be respected accordingly. George Granger, General Manager?'"

The smile on Sand's face was as childish and bland as that on Bret Harte's Chinaman, as he replied: "Yes, that would look nice, and I thank you for the offer; but Chaunce said last night that if you took G. M. of the Northern, I couldn't do anything on it, positively. He knows I expect to marry your daughter, and he doesn't approve of having connections together on a road that way at all. Says it looks bad and is bad, and he'll fix me out on one of his other roads—maybe the New England, so I won't have to take Mary so far from her folks."

"That's too bad," said Granger, but yet felt relieved, for he was already planning some way to leave Sand out without jeopardizing his own position. He didn't want anyone around who could say to him: "I put you where you are." He felt that somehow his merit was at last being recognized, and his reflection in the big mirror opposite was that of a general manager, not that of an engineer.

Fred sat watching him keenly, and probably divined his thoughts; for the smoke from his cigar suddenly choked him and made him cough suspiciously, if Granger had noticed it.

"Another thing Chaunce said," Fred remarked, after clearing his throat of the smoke, "is that they are short of power, and he wants you to order ten new engines; get 'em where you like, and the kind you like. He says the Brooks engines they've got don't fill the bill, and they've got two or three Portlands that are no better. They're extending the road now and you'll have to order them at once."

"I'll get them at Grant's or Baldwin's," said Granger, proudly. "I know what an engine is and I'll get them the right kind."

"That's what Chaunce said," replied Fred. "He said you would know all about engines and could order them better than anyone else."

"Yes, I do," said Granger, "and I'll get them all like the '77' exactly."

"Crown sheet and all?" said Fred.

"Crown sheet and all," replied Granger, sharply. "She's an engine!"

"Another thing he said," went on Fred, "was that, as they open more of the extensions and you are successful, he'll raise your wages."

"That's good," said Granger; "but in speaking of officials you should say 'salary.' Switchmen and engineers are paid 'wages'; officials receive 'salaries.'"

"All right," said Fred; "but as I was out with Chaunce nearly all last night, I'm sleepy and guess we'd better go home. You had better think over your engines and make selections for your officers, for Chaunce expects you to rustle when the 1st comes."

As they passed the cashier's desk going out, Fred nodded carelessly; a proceeding that made a great impression on Granger, and would have made more had he known just how many dollars it took out of Fred's savings to clear the way for the nod. And as Fred said "Good night" to Granger, after declining an urgent invitation to "come in," he thought: "Great snakes! I'll be bankrupt by the 1st, and if we should get married, I won't have enough left to pay for a wedding tour to Coney Island!"

Inside of twenty-four hours the whole First division of the Western knew all about it, and Granger's dignity was wonderful to behold. He handed in his resignation, to take effect at once, and was indignant when the master mechanic urged him to take leave of absence for thirty, sixty or ninety days instead. "The idea!" he said. "Do you suppose I'll ever come down to running an engine again?"

"Don't never prophesy unless ye know," replied the master mechanic, drily; "but I hope you may not come down."

"Of course I won't," said Granger, with dignity.

Granger went home, after taking a last fond farewell of the "77," and burned up his overclothes. Then began a time of the greatest excitement ever known on the First division. Every man on the division who was not skeptical, and the skeptics were few, wanted a job of some kind from Granger; from the pitmen up to some of the minor officials, and all applications were loftily received by Granger, whose stereotyped reply was: "I'll consider your application later—after the 1st. I'm too busy to do anything for you now," and the dance went merrily on.

Sand said nothing and sawed wood. He arranged two or three other meetings between Granger and Chauncey P. Green; but each time a message from Mr. Green at the last moment announced that he had been imperatively summoned elsewhere, but that all arrangements Sand had made were approved by him. All that worried Fred was that he couldn't hurry up the wedding, and the thought of the rapid manner in which his savings were dwindling down. As Granger didn't care to have it known that he owed his elevation to a switchman, and as Fred felt that ignorance was bliss anyway, neither one told how it was brought about and everyone was guessing. The Western officials were mildly skeptical, but took care not to be offensive in case it might prove true. Then Granger announced his selections for officials that were to reorganize the Northern service under his directions. Lew Coss, the first trick dispatcher, handed in his resignation; he was to be superintendent under the new general manager, and as Lew was very popular, and it wasn't a bad idea to be good to a man who was advancing officially, a paper was hastily circulated for subscriptions, and Lew was given a big supper, at which he was presented with a valuable gold watch and chain. His successor was duly named to take his place on the eventful 1st. Conway, the branch trainmaster, was to be assistant superintendent, and he, too, resigned, but got no watch. Hank Redwood, the night engine dispatcher, was to be master mechanic; but Hank took thirty days' leave of absence, commencing with the 1st. Meanwhile, Granger had gone to Philadelphia to see about ordering ten engines, duplicates of the "77," but was advised to wait until he had actually taken possession of the office. They didn't care to do business in futures, and his protestations that the engines were wanted in a hurry, and that he would have to go elsewhere, failed to move them.

Fred was anxious to have the wedding before the 1st and Granger was anxious to meet Chauncey P. Green before the 1st—they both sparred for time. Granger told Fred the wedding couldn't possibly be arranged for until after he was settled in his new position, and Fred reported to Granger that "Chaunce" had been taken sick and was confined to his bed. "He told me that everything is arranged for," said Fred, "and that his private secretary has the notices properly signed, and will bulletin them and give the announcement to the papers on the morning of the 31st, and that you are to go to the office and take possession on the 1st at 10 A. M. But I'm afraid poor Chaunce will kill himself," he added; "It's foolish for a man with his money to work so. He looks bad."

At last the 31st came, and Granger was determined to see Chauncey P. Green. Fred had to telegraph in order to satisfy Granger, and the reply was signed, "Chauncey P. Green, by E. P., Private Sec'y," and said that Mr. Green was too ill to see anyone at all, but that all arrangements were made for Mr. Granger to take possession at 10 A. M. the next day, and Granger felt somewhat reassured. He wanted Fred to go with him the next morning; but Fred, who was very glum after a last desperate effort to get Mary to go with him to a minister's residence and get married at once, declined. "Chaunce wouldn't want me to go poking around with you," he said, "and he wouldn't like it at all. He might think you wanted backing."

So Granger started off alone. He hired a hack and drove grandly up to the L. & Northern offices, where he arrived at just 10:10 A. M.

He walked firmly up the stairs and along the corridor, until he came to a door marked "General Manager — Private." Boldly opening the door, he walked in. A gentleman sitting at the desk looked up surprised, and the stenographer at the typewriter looked amazed at the intrusion. Granger nodded to them; said "Good morning," and took off his light overcoat and hat, looking for a place to hang them up.

The man at the desk was speechless, and the stenographer looked anxiously at the doorway to another office, as if contemplating flight. "I believe this is my private office and I suppose that is my desk," said Granger, with dignity. The stenographer looked still more anxiously at the doorway, and the man at the desk finally recovered sufficiently to exclaim: "Well, who in thunder are you, anyway, and what do you want?"

"I'm the new general manager," replied Granger, calmly.

"The *new* general manager!" ejaculated the man at the desk, as the stenographer bolted through the other door. "Then who am I?"

"I don't know who you are," said Granger, as a number of clerks and officials came running into the office, alarmed by the stenographer. "You'll find notice of my appointment on the bulletin."

Thinking he was dealing with a mild lunatic, the man arose from the desk and said: "Well, let's look at the bulletin. I've been general manager here for four years, and I didn't know my place was vacant. There's the board—I don't see the notice."

Neither did Granger, and he stammered: "Mr. Green was to have the notice up yesterday."

"Mr. Green?" asked the other. "Chauncey P. Green?"

Granger nodded.

"Why, he hasn't had any connection nor any interest in this road since the annual meeting last March. My dear sir, I fear you are the victim of some hoax."

In a daze, Granger walked out without a word. In a daze he wandered around the streets all day, taking care to keep away from his home neighborhood. About dusk he reached home. He was recovering from the shock by this time, and was beginning to feel like wreaking vengeance on Fred Sand. To his surprise he found Fred at his home, talking with Mrs. Granger and Mary, and before poor Granger could say a word, Sand advanced and offered his hand and congratulations.

"Fred, what have you done? What have you done?" groaned Granger, sinking into a chair.

"What do you mean?" demanded Fred.

"Why they don't know a thing about it at the Northern offices. Have you been fooling me?" he demanded fiercely.

"You know better than that," said Fred, earnestly. "You saw all the letters and telegrams yourself. I can't understand it, but it must be due to poor Chauncey's sickness. I'll get a hack at once and we'll go to see him, alive or dead."

Fred was gone but a few minutes for the hack, and as he helped the limp Granger into it, he directed the driver to drive as fast as possible to No. —— Four Hundredth avenue.

In a short time the hack stopped in front of one of the mansions on that fashionable avenue, and Fred, jumping out, said: "You wait in the hack until I find out if we can see him."

Poor Granger, sitting in the hack and still dazed, didn't know that Fred had located this house because its occupants were in Europe. He didn't know that Fred, concealed in the vestibule, saw only a servant who was taking care of the house during the family's absence, nor that his question was only as to the residence of some imaginary personage in the neighborhood, nor that Fred managed to keep the servant talking long enough to let a plausible time elapse before returning to the hack.

When Fred returned to the hack he had a handkerchief to his eyes and his voice was husky.

"What is it?" asked Granger, eagerly.

"It's all clear now," said Fred, sadly. "Poor Chauncey died at three o'clock yesterday afternoon."

Railway Accidents of a Year.

A report of the Interstate Commerce Commission, recently received, says concerning railway accidents:

"The number of railway employés killed during the year ending June 30, 1895, was 1,811, and the number injured 25,696, being a decrease of 12 in the number of employés killed and an increase of 2,274 in the number injured.

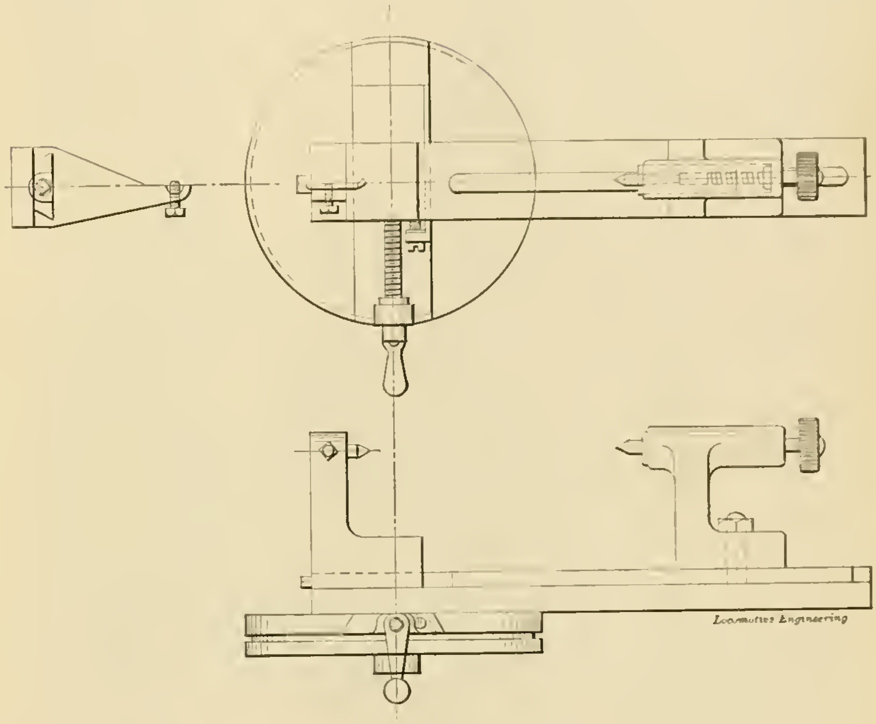
"The number of passengers killed during the year covered by the report was 170, and the number of passengers injured 2,375, being a decrease in the number of passengers killed of 154 and in the number injured of 659. It is worthy of remark that the number of passengers killed during the year covered by the report is less, both relatively and absolutely, than during any year for which complete statistics are obtainable.

"It appears that during the year covered by this report 1 employé was killed for each 433 employés, and 1 was injured for each 31 men employed in the railway service. Of trainmen—that is to say, engineers, firemen, conductors, and other employés whose service is upon the trains —it appears that 1 person was killed for each 155 employés of this class, and 1 person injured for each 11 trainmen. The number of passengers carried for each passenger killed during the year covered by the report was 2,984,832, and the number of passengers carried for each passenger injured was 213,651. The liability of accident to passengers varies, of course, other things being equal, with the length of the journey. A more accurate statement of the liabilities sustained by passengers according to the results of the year covered by this report is that 71,696,743 passenger-miles were accomplished on the railways of the United States for 1 passenger killed, and 5,131,977 passenger-miles were accomplished for 1 passenger injured.

"From the above comparative statement it is clear that the year ending June 30, 1895, is more satisfactory, so far as accidents are concerned, than any previous year. Reference was made in last year's report to the fact that the marked reduction in the pay-roll of the railways, by which the incompetent and inefficient were dropped from the railway service, and the consignment to the scrap heap of equipment worn out or out of date, were largely responsible for the greater safety in railway travel and railway employment shown by the statistics of the year. The result of raising the character of railway service and grade of railway equipment is yet more marked during the present year, and to this must be added the fact that the demands upon the passenger service during the present year have been somewhat decreased. It is also worthy of suggestion, although the facts yet at command are not adequate for confident assertion, that the fitting of equipment with automatic devices is beginning to show its beneficial results. The class of employés most liable to those accidents which automatic couplers and train brakes are designed to avoid is trainmen, and from the previous statement it appears that but 1 trainman for each 155 in the railway service was killed in 1895, as compared with 1 trainman killed for each 105 employed in 1890. But it is easy to lay too great stress upon this consideration."

Ball-Joint Grinder.

An attachment for a grinding machine to do ball-joint work is shown herewith. This device is mounted on the table of any machine where grinding is done, or in any convenient position before an emery wheel, and when fastened in place is well adapted to the work it was gotten up for.



BALL-JOINT GRINDER.

The work to be operated on is secured on the centers, and when there, any required position between the work and emery wheel is obtained by means of screws giving either a longitudinal or transverse motion to the frame carrying the work on the centers. Rotation about the grinding wheel is had by means of the lug shown at the bottom of the base plate; the lug fitting in a corresponding recess in the table of the grinding machine, which is not shown. All ball reamers, whether solid or of the inserted tooth type, are neatly put in shape with this device, which was gotten up by Mr. D. C. Shepard, the tool-room foreman at the Pavonia shops of the Pennsylvania Railroad at Camden, N. J.

The First Railway Strike.

The first railway strike on record was caused by opposition to a proposed improvement in the material for the track. Early in the last century, a wooden tramway was used in connection with the Duke of Norfolk's colliery, near Sheffield, England, for facilitating the transportation of the coal. The wheels of the wagons ran on wooden stringers, which wore out very rapidly and caused a great deal of expense and labor in maintenance. In 1776, one John Curr proposed to put in a more substantial form of permanent way. After some negotiations with the proprietors of the colliery, Curr built a cast-iron tramway, the rails being spiked upon wooden sleepers. The plan was bitterly opposed by the laboring people of the colliery, and a riot ensued in which the track was torn up and stringers and coal station burned up.

The author of this improvement in permanent way had to take to the woods to escape the fury of the conservative element, and he lay concealed for several weeks, then escaped to other fields where his delinquencies were unknown.

The "Tramp" compound of the Richmond Locomotive Works has just finished a service test on the Louisville & Nashville Railway, and goes on the Wabash at once for experimental runs between St. Louis and Decatur, which will be watched with interest. The Louisville & Nashville Railway has made no report yet, but it is understood that the engine has given perfect satisfaction and showed great fuel economy.

Where Balanced Valves Were First Made a Success.

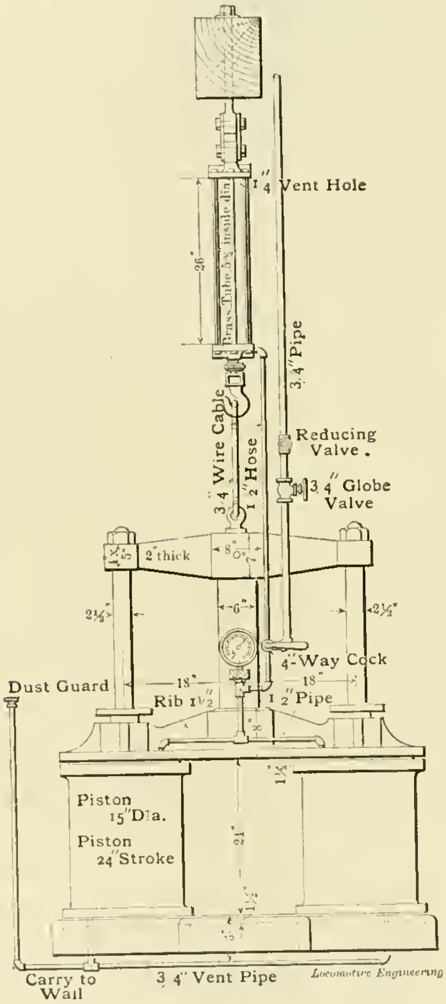
A great many attempts were made to use balanced valves before any degree of success was obtained with them. The subject was repeatedly up before the Master Mechanics' Association for discussion. Several men, who appeared interested in special balanced valves, spoke hopefully of the advantages to be derived from their use, but after a little experience they nearly always fell back to the conclusion that there was more annoyance caused in keeping a balanced valve in working order than there was benefit derived from its use. About the time that the balanced valve began to get hopelessly discredited, Mr. George Richardson, the inventor of the well-known pop safety valve, called upon Mr. Underhill, superintendent of motive power of the Boston & Albany, and wished to apply a balanced valve of his invention to a locomotive. Mr. Underhill had heard a good deal of talk about balanced valves in his time, and had some experience with their use, so he did not want to have any conversation on the subject. Mr. Richardson, however, proved intensely persistent in his desire to put a balanced valve on a locomotive belonging to the Boston & Albany. He offered to do the entire work himself, and to take the valves off if they did not give satisfaction; and he promised in no case to bother anyone by talking about the valves, whatever their record might be.

Under these conditions, permission was given to put in a set of valves, and the work was done. Mr. Underhill forgot all about the circumstances till four years afterwards, when the engine happened to be in the shop for repairs, and the foreman came and asked him if anything should be done to the valves. They had run all that time without being touched, and on examination they were found to be in good order. That set of valves ran nine years without any repairs. The balanced valve had proved itself worthy of adoption in such a quiet, unassuming way that others were immediately put on the Boston & Albany locomotives, and the device has long been a recognized feature of the engines. The success which it attained on the Boston & Albany did more than anything else to push it into favor with other railroads.

Seventeen-Ton Pneumatic Press.

The pneumatic press shown in the engraving was designed by Mr. F. B. Griffith, master mechanic of D., L. & W. shops at East Buffalo, for general use in his shop. This machine was built from new material throughout, and planned to give a squeeze up to 17 tons with a pressure of 100 pounds of air per square inch of piston, of which there are two, working in cylinders 15 inches in diameter and 24 inches stroke, arranged vertically side by side.

A heavy crosshead connects the two pistons at the upper ends, at the center of which is secured the 6-inch ram, the latter being guided at its lower end by the casting, which ties the two cylinders together at the top. To raise the ram from its lowest position, it is connected by a wire cable to the piston of a 5¾-inch air hoist, which is suspended above the press. The tool is mounted on a neat cast-iron base, and gotten up in harmony with the other excellent air appliances that Mr. Griffith has in use in his shops, among which may be cited an air lift at the driving-wheel lathes.



These lifts travel on a circular track and are operative in every direction desired—all motions controlled by air—making one of the most complete devices for the purpose ever worked out.

Another arrangement worthy of mention in this connection is a traveling air lift, having all the functions of a traveling crane within the capacity of its lifting power, and that at a merely nominal first cost. It consists simply of small air cylinders with a long piston travel, say 8 or 10 feet, the motion of which can be had in either a vertical or horizontal plane, in which latter direction it is multiplied so as to cover 200 feet or more by means of multiple sheaves and a cable of the proper length. There is no cheaper method for transferring work in a shop than has been evolved in this scheme. Both these lifts are patented, and their virtues will be somewhat lessened (to the pirate) in consequence—but they are a good thing.

The Taper Fit.

Truly cylindrical bolts used to be almost universally used in locomotive work for all purposes, but the taper fit is steadily becoming universal. The only merit of the straight hole was its cheapness. It cost little skill or labor for a good workman to bore a straight hole and turn a straight plug; while to taper the hole and taper-turn the bolt to make a true fit, required skill and time.

A taper fit, when well done, can be depended upon to give a more uniform bearing that a straight fit, and a bad fit cannot be hidden so readily as in the case of a straight fit. A taper fit gives a great advantage when the time comes for removing the bolts from such places as frames, cylinders and rods. They can be driven out much more readily than a straight-fitted bolt, and they can be replaced and made a perfect fit a second time.

A rather striking illustration of the difficulty of handling very heavy guns for coast defense was given by Secretary Lamont in a recent report. He said: "How difficult a problem it was will appear when it is noted that such a carriage must endure, without breaking or straining any of its parts, the tremendous shock due to the ballistic force necessary to propel a 1,000-pound projectile at a velocity of 2,100 feet a second, lowering its 52-ton gun for a distance of nearly 8 feet to secure a position for loading and returning it to its firing position, and that it must do this rapidly, certainly and easily, and by mechanism not liable to get out of order and easy to be operated by the average soldier. The technical difficulties involved may, perhaps, be better appreciated when it is considered that a similar case would be that of a 50-ton locomotive and tender, running at a speed of 20 miles per hour, which is required to be brought to a full stop from this speed within a distance of 16 feet, or one-third of its length, yet so easily and gently that at the end of the motion there shall not be the slightest jar."

The Leslie Rotary Snow Shovel Company disposed of their property recently to an organization known under the style and name of the Rotary Snow Plow Company—Fred. W. Cooke, President; Jas. S. Cooke, Vice-President; Chas. D. Cooke, Secretary and Treasurer. No part of the old organization is in the new. The Cooke Locomotive & Machine Company will continue to build the rotaries as heretofore. Two new plows are now in course of construction for the new company.

The First Cases of Reducing Expenses.

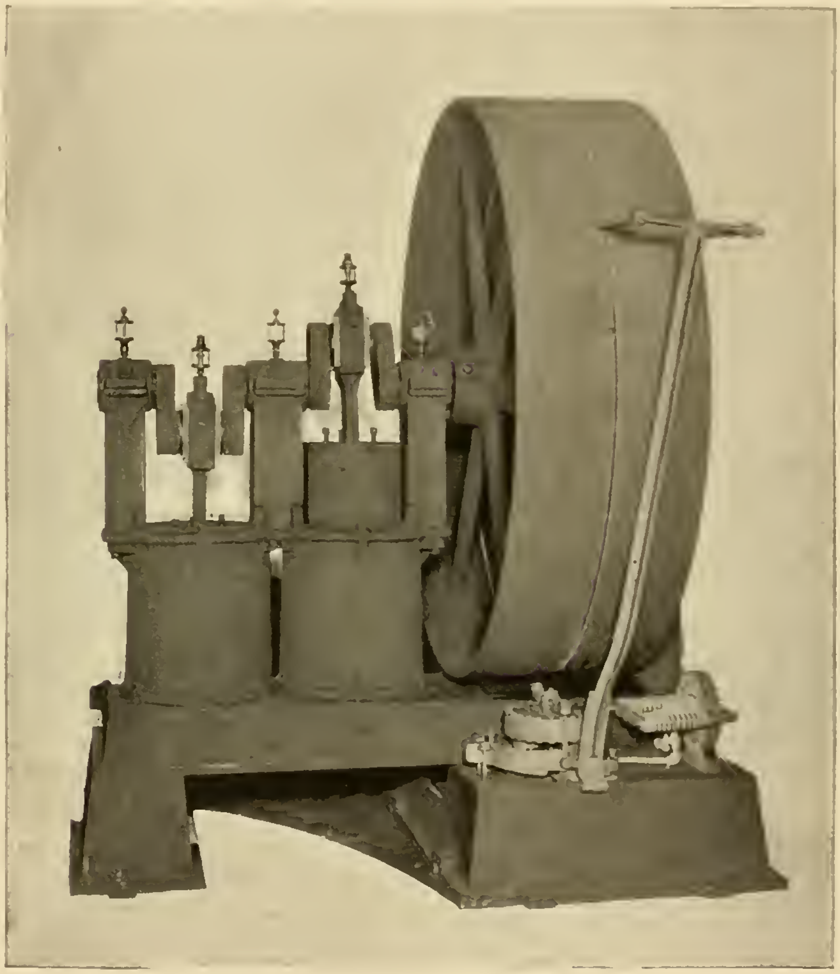
When the first railway was built in London, in 1836, the conservative people, high and low, of England's greatest city, looked at the enterprise as one of the most ridiculous attempts ever heard of to change people's established habits. The idea of deserting omnibuses and hackney coaches to ride behind a "puffing fire engine," as a locomotive was then called, was considered absurd. The first railway there was extended from the neighborhood of London Bridge to Greenwich, and was known as the Greenwich Railway.

The directors seemed to understand how to deal with the prejudices of the populace, for they proceeded to make the railway an attraction, calculated to rival a big circus. To make the show draw, a band of musicians, dressed up like beefeaters (royal servants), was stationed at each end of the road, and discoursed music to attract the curious. Then glib-tongued tooters expatiated on the joys of a ride on the rail. The show part, which might be called the early advertising department, soon became the object of retrenchment; for within a few months after the show was started, barrel organs were employed in place of the brass bands, one man doing the work of half-a-dozen. This was really the first radical move made to reduce operating expenses of railroads. As usual, the directors did not rest satisfied with the first reduction, for they shortly afterwards abolished the musical feature altogether.

Another feature of the Greenwich Railway was, that the whole length of the line was lighted up at night by a row of lamps on either side, like a street. This was done to enable the engine drivers to see if any curious person had climbed over the fence to examine the track and was putting the lives of himself and passengers in jeopardy. There was also an impression that artificial light was needed to enable the engine driver to regulate the speed at night. A little experience taught the managers that lights were not needed to enable the engine driver to do his work, and it was found that the tresspasser endangered only his own life, so the second act of cutting down expenses was abolishing the lights on the right of way.

Richards' Automatic Belt-Driven Air Compressor.

The air compressor here shown has been designed to meet the rapidly growing demand for such a machine for shop service, and is adapted for maintaining a constant supply of compressed air at the lowest power cost and without requiring any attention. It is entirely automatic in action, stopping and starting itself as the pressure rises or falls, and the occasional filling of the oil cups is all the looking-after required. There are two vertical compressing cylinders completely water-jacketed with trunk pistons, each of course single acting, 10 inches diameter and 10 inches stroke. At 110 revolutions per minute, which is a very moderate speed as compressors are run, 100 cubic feet of free air per minute are compressed and delivered. Either cylinder may be used independently, giving one-half this capacity. The inlet and delivery valves are under the cylinders, easily accessible and easily removable. The air delivery pipe, at the back of the machine, is 2 inches diameter. The delivery pipe and the shipper may be on either side of the machine as ordered, and the shaft may turn in either direction. The pulleys are 56 inches diameter and 8 inches face, giving ample belt surface for easy driving. The normal position of the belt shipper is with the belt on the driving pulley, it being drawn to that position and held there by springs. The vertical diaphragm at the right is connected with the air receiver and is adjusted to act at the required pressure. When this pressure is reached, a small valve admits air pressure to the horizontal diaphragm, and the shipper is thrown over and the belt is held on the loose pulley until the pressure falls, when the machine immediately starts again.



RICHARDS' BELTED AIR COMPRESSOR.

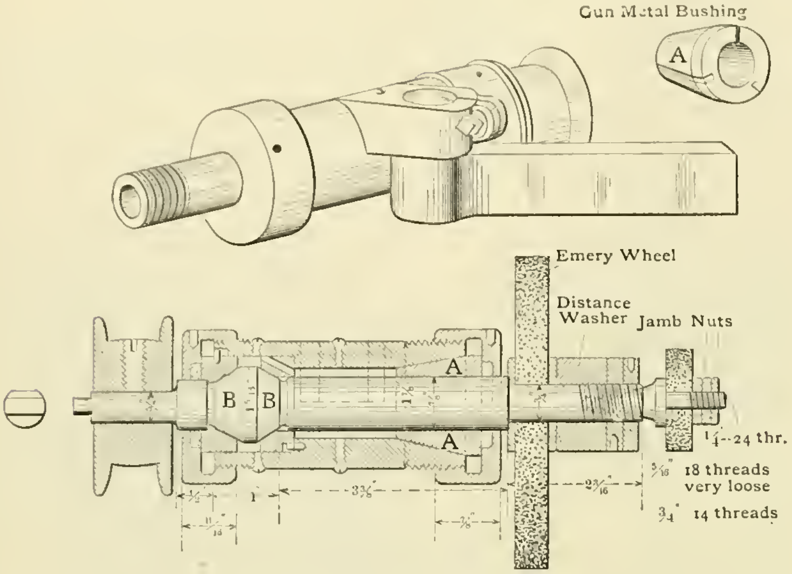
The compressor is from designs, upon which, we understand, patents are pending, by Frank Richards, and is made and sold by M. C. Hammett, Troy, N. Y. Three of these machines have been running several months in shops of the Lake Shore Railroad, and one in the Middletown, N. Y., shop of the New York, Ontario & Western Railroad.

With the increasing steam pressure employed in locomotive boilers, there is a great deal of difficulty experienced in keeping valves and pistons running smoothly. Improvements in lubricators and in lubricating material do not seem to be sufficient to overcome the difficulty. In connection with this subject, it is strange to reflect that there is a great tendency among marine men to stop the lubrication of pistons and valves entirely, although the steam pressure in marine boilers is about equal to the pressure of locomotives. On the White Star boats, no lubrication whatever is employed, and several other companies follow the same practice. The objection to lubricating oils in the cylinders of marine engines is that it passes through the condenser into the boiler and forms an insoluble soap on top of the furnaces, causing accidents from over-heating. The marine engineers who have charge of engines that get no lubricating say that they have very little difficulty from valves and pistons cutting.

Traversing Grinder for Lathes.

Our illustration of a grinding attachment for lathes was made directly from sketches furnished us by the builder of the device, Mr. W. G. Thomas, foreman of the tool-room of the Lehigh Valley shops at Sayre, Pa. It is got up on lines that are mechanical throughout, as will be seen by an examination of the cone bearings to keep lost motion down to the minimum, and also by the care taken to exclude all abrasives from the bearing parts. For the latter purpose, felt washers are used under each adjusting nut at the ends of the bearings.

The clamp shown at the center of the body, engages with the shank which fits the lathe tool post, and thus allows for adjustment of the grinder to any angle. There is provision made on the shaft for two sizes of grinding wheels, making the tool almost universal in its adaptability to the general run of tool-room grinding; but it is specially efficient on long work that is required to be as round and true as tools can make it. It is driven from a drum of a length sufficient to take in anything within the limit of the lathe centers. The endless uses to which a tool of this character can be put would seem to make it indispensable to proper tool management, but it is a fact that there are very few in use in railroad shops.



A NEW GRINDER FOR LATHES.

More Phosphorus Than He Thought.

In the course of a discussion on the Bessemer process of steel-making, at a meeting of the American Society of Mechanical Engineers, President Fritz, of the Bethlehem Steel Works, mentioned a curious fact, which delayed the making of Bessemer steel by the Bethlehem people for two or three years.

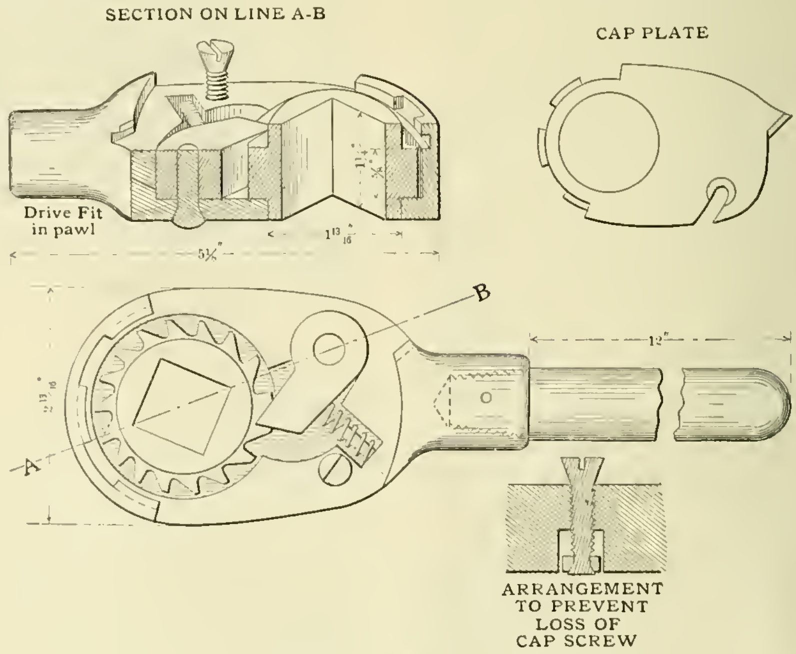
When the Bessemer process was first successfully used in England, the Bethlehem people were willing to introduce it; but before doing so, they applied to Mr. Bessemer to find out what quality of ores or iron could be used in the process. He assured them that the ore or pig had to be unusually pure, more than .02 of 1 per cent. of phosphorus not being admissible. As the Bethlehem Steel Company could not conveniently obtain ore or iron so free from phosphorus as Mr. Bessemer said was necessary, they decided not to attempt making steel by the Bessemer process.

About two years after this decision was made, the Lehigh Valley Railroad Company imported a lot of Bessemer rails from England. Some of the rails got broken when being unloaded, and Mr. Fritz got one of them and had the material analyzed. Specimens were sent to an expert chemist, who made the necessary tests and found that the rails contained .12 of phosphorus, being six times more than what Mr. Bessemer said was admissible. Plenty of American ore was available for making steel with half the quantity of phosphorus that the imported Bessemer rails contained, and the Bethlehem people lost no time in having a Bessemer plant in operation.

A Reversible Ratchet Wrench.

We present herewith a neat and mechanical ratchet wrench operative in either direction. It was built in the tool room of the Sayre shops of the L. V. R. R., which are presided over by Master Mechanic Weaver. The cap plate is locked in place by means of three lugs or projections fitting into corresponding recesses in the upper face of the body, but in such a position that these parts do not coincide when the plate is in its proper place. A lip or flange on the top face of the body prevents any upward action on the plate, and a cap screw holds it laterally.

The arrangement to prevent the cap screw from backing out, consists of a nut on the bottom, and in addition to this, the screw itself is put into the body at a tight fit, and these two features in combination prevent any tendency to movement in the screw. The beauty of this wrench lies in its lightness, and the accessibility of its parts when the cap plate is removed.



REVERSIBLE RATCHET WRENCH.

We understand that the Westinghouse Electric & Manufacturing Company are about to resume the work of developing the Westinghouse-Baldwin locomotive. A variety of experiments with this form of engine were made several months ago, but were suspended, owing to the depression of business.

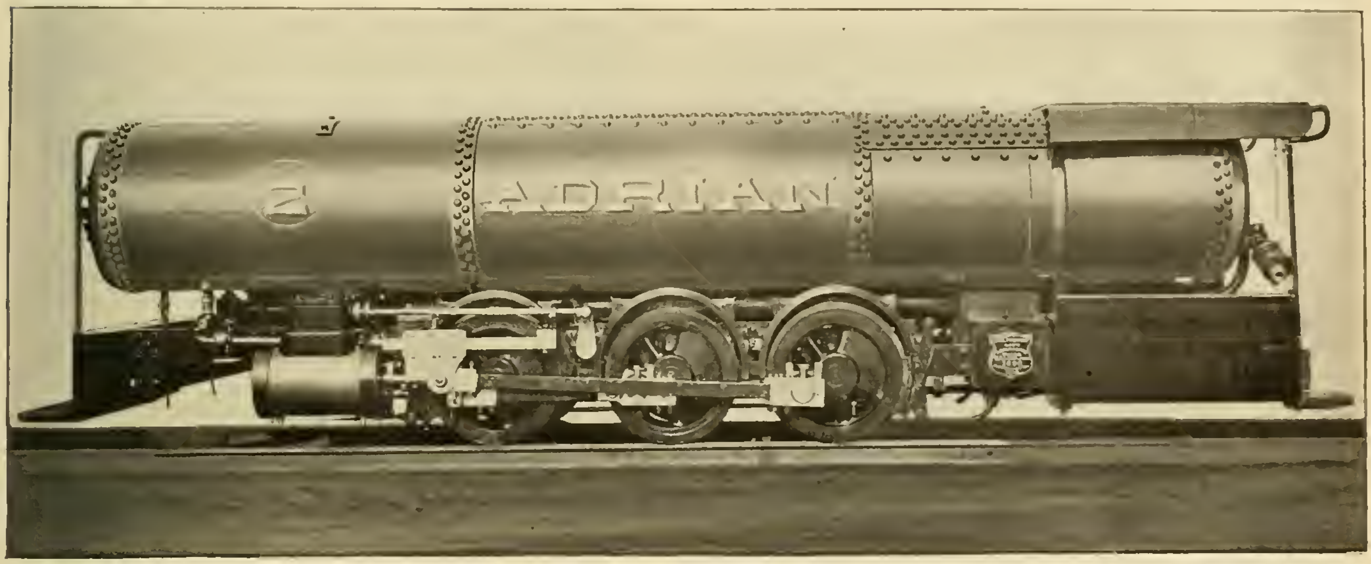
Compressed-Air Locomotives.

Among the most promising uses for compressed air for the transmission of power is that of locomotives working in places where the gases of fuel combustion are objectionable, and for places where inflammable materials are liable to take fire from sparks thrown by ordinary locomotives. Of late, H. K. Porter & Co., Pittsburgh, have received orders for the construction of numerous locomotives to be operated by compressed air. The six-wheel engine shown is one of the latest built by the company named. The air reservoir looks like two boilers set side by side. It was built for the Adrian mines of the Rochester & Pittsburgh Coal & Iron Company, near Punxsutawney, Pa. This makes three of these locomotives which H. K. Porter & Co. have furnished this company. The locomotive "Adrian, No. 2," shown by the photograph, is a very powerful machine, representing the most improved practice.

The cylinders, 9½ inches diameter by 14 inches stroke; six 26-inch driving wheels; weight in running order, 27,000 pounds; height, 5 feet 3¾ inches; width, 6 feet 2 inches; length, 19 feet 5¼ inches; two motor tanks, adapted to a regular working pressure of 600 pounds; supplied with metallic couplings, and fitted with reducing and regulating valve; and auxiliary reservoir, using the air in the locomotive cylinders at about 120 pounds pressure. The engine is equipped with a very powerful brake to the driving wheels.

This engine can be charged to the full pressure in about one minute. As compared with a steam locomotive, we notice one interesting item of saving of power, viz., that as the exhaust openings are large, and not contracted, as in the case of a steam locomotive, for securing a blast to drive the fire, there is no back pressure whatever, and the indicator diagram shows this conclusively, giving an advantage over steam of perhaps 5 to 15 pounds.

This locomotive is to operate grades as steep as 3 and 4 per cent. for empty trains, and about 1¼ per cent. grades against the loads, getting out 1,200 tons of coal per day, on a haul of about 6,000 feet.



AIR LOCOMOTIVE FOR MINES.

Economical Uses of Compressed Air.

"In our machine shops, air is now as important as steam. It is performing many things better than steam did, as there are many tools about a shop that are run by air that could not be run by steam. A three-cylinder Brotherhood engine, operated by air, is one of the most important tools in the shop. It is mounted on a small iron truck and can be readily moved. All complete, it does not weigh over 200 pounds. It will run an 18-inch slotter or a 42 x 42-inch planer; it will run a small driving-wheel lathe and turn tires up to 56 inches in diameter; it will run a lathe for turning steel-tired car wheels; it will run a drill press, a bolt cutter or any single machine, and frequently it will save running the whole shop when it is necessary to run one machine only. A press for rod work, driving-box brasses, or other work that does not require over 15,000 pounds on the piston, is a great improvement over the old screw press and much quicker.

"An emery wheel driven by air, on the principle of the Pelton water wheel, makes a very handy tool for light grinding; two 6-inch emery wheels on one shaft can be run from a ¼-inch pipe. A transfer table 100 feet travel can be successfully run by air by using a small engine.

"Among the many uses of air in our shops that of blowing out steam passages in cylinders commends itself at once. To do this fill the boiler with air at 100 pounds pressure, blow out the ports, put in the pistons, fill the boiler again with air, and run the engine out of the shop into the roundhouse. You have burned no wood, nobody has waited for the engine to get hot, and you have saved several hours in time in finishing the engine. In testing staybolts with 100 pounds of air pressure on the boiler, a broken staybolt is immediately detected when sounded with a hammer, when it might not be discovered if sounded when the boiler was empty or full of water.

"At the scrap pile, a cheap and effective shear for cutting off bolts to length can be made by using two short pieces of 16-inch I-beam, and a passenger-car brake cylinder which can be made to work automatically or by hand. A freight-brake cylinder, set in an upright wooden frame, with an anvil below and a steel head on the end of the piston rod, makes a good automatic hammer for straightening bolts and rods. The valve motion to the hammer consists of an ordinary three-way cock, with a lever attached to the plug, and a ½-inch rod connection to the end of the piston rod. The supply of air regulates the stroke. It can be regulated as closely as a steam hammer, and will strike two hundred blows a minute if desired. These tools can be located anywhere about a yard.

"A 16-inch cylinder makes a press for the tin shop, and with the proper dies and stamps the largest part of your tinware can be cut out, stamped and flanged ready to be put together. Galvanized iron water pails, dope and other buckets are made in this way in pieces. The sides are cut out in sections, two sections forming the pail. The bottom is cut out and flanged at one blow. The tops and bottoms of tin or galvanized oil cans are made this way, also engine oilers, oil cans, spouts, tallow pots, water-glass lamps, and a great variety of tinware can be made more cheaply and quickly than by hand.

"Attach a small air cylinder to the splitting shears in the sheet-iron shop, and you have a very effective shear for splitting sheets from three-sixteenths of an inch in thickness down.

"A portable forge for rivet heating and light blacksmith work is made by using a 3-inch iron tube below the fire plate. Extend this down below the bottom of the forge, connect a ¼-inch gas pipe, use an elbow on the pipe, screw in a brass nipple with a 1-32-inch hole for the discharge, place the top of the nipple there ⅜-inch above the bottom and in the center of the tube, and use a ¼-inch globe valve to regulate the supply of air. With this forge rivets can be heated faster than two gangs can drive them, and a welding heat can be made on a bar of 2½-inch round iron.

"In the office, attach an 8-inch cylinder to the letter press for copying letters; you will like it so well that you will not want any more screw letter presses.

"The application of air in a sandhouse as a means of elevating sand to a tower where it can be discharged through a spout into the sandbox of the locomotive, has been adopted on a number of railroads. A passenger-car auxiliary reservoir, with the necessary air connections, makes a convenient and economical machine for kindling fires in locomotives with oil. In a blacksmith shop, a blast for all fires can be supplied by compressed air and the fan blast dispensed with, experiments in this direction having demonstrated the success of this plan.

"New applications of air are constantly being made about railroad shops; each new application suggests another, and no shop is complete at the present time without an air compressor. Even small shops can afford to dispense with locomotive air pumps and buy a compressor, because one that will furnish as much air as six pumps can be purchased for about $800.

"The economies effected by the use of air will, in a short time, pay for a complete air plant. A large reservoir supply is a great advantage; the larger you have it the more economically can the system be operated. A machine shop to-day can be fitted up to a better advantage and for less money than ever before. No main-line shafting extending the entire length of the shop is necessary. A short line shaft may be used for heavy machinery, and all the light machinery may be driven by air.

"The last five years have produced many useful compressed air tools, and the future will bring out others. Manufacturing establishments are investigating the advantages of air, and all railroad shops are more or less engaged in bringing out new appliances, so that we are all looking to the future and wondering what will be the next application of compressed air in shop practice." — J. H. McConnell, at Western Railway Club.

Rambles in Europe--Geneva to Turin.

[EDITORIAL CORRESPONDENCE.]

There has been so much agitation going on in this country about the abolishing of highway crossings over railways that many people believe that the United States and Canada have a monopoly of highways going across railway tracks on the same level. Very little travel on the continent of Europe convinces one that other countries are as great sinners in this respect as we are, and in many cases with less justification. I have traveled in nearly every country in Europe and find outside of the British Isles that level crossings are practically universal, and more than that, the railway companies do not appear to make the least effort to lead the roads above or below grade when that could be done at very little expense.

Familiar features of all continental railways are the numerous level crossings with carefully closed gates, a neat crossing-keeper's house and the meek-eyed woman standing by the gate embracing a red flag with military precision. They all stand with drooping eyes, as if they were too timid to gaze at the train, although occasionally I noticed the flag fluttered in response to gestures of waggish engine drivers. I fancy these women railroaders are not so meek with their husbands.

This reminds me of a small gate-keeper romance that happened in the British Isles when these crossings were not so rare as they are to-day. On a certain railway there was a guard of the Adonis tribe who considered himself a veritable lady-killer, his principal game being the daughters of station masters and other employés who had houses on the company's property. In the course of a few years this man began to have a shady reputation which extended from one end of the division to the other, for his actions were not confined to ogling when occasion served. There was a gate-keeper of a crossing who had a pretty daughter, and this girl took charge at certain times to relieve her father, and, of course, was in evidence. Adonis had grinned his sweetest grins and grimaced his most alluring grimaces for years to this girl before it seemed that she became interested. Then he began throwing her amorous epistles. This was succeeded by requests that he should be permitted to visit the girl at night, when she was in charge. It came about that permission was granted. When the would-be lover arrived quietly at the gate hut, he found, not one, but four young women. They fell upon his neck, and they brought forth each a big calcimine brush, which was dipped into a capacious bucket of whitewash, and the guard was anointed from the top of his head to the sole of his brogans. When the girls ceased their attentions, the swain went, and stood not on the order of his going, staying not even to gather his hat that had disappeared during the fray. As he approached the nearest station he created general consternation, for the belief in ghosts still lingered in that district. The swain was ridiculed so much on this adventure that he went and enlisted for a soldier.

When I meet Americans traveling in Europe who have never seen any of the romantic and grand scenery of their own country, it makes me melancholy to listen to their effusive admiration of every hill, glen, river and lake. I met a party of young American women in Savoy, most of them from Philadelphia, and several of them admitted that they had never seen Niagara Falls. They were fascinated with the pretty scenery traversed by the railway on its way to Italy, but short of the Mount Cenis surroundings they might have witnessed scenes quite as attractive by riding over the Lehigh Valley Railroad from Philadelphia to Buffalo. But, then, that would not have given them the right to boast that they had "done Europe." In all my travels I was amazed at the number of American women I met. When men were found in parties, they seemed to be sprinkled in by accident and they always appeared bored. The masculine-like independence which our women assume while traveling is irritating to a man who wishes to see his countrywomen respected.

The places a traveler sees in Southern France and Northern Italy are enough to stir up sentiment even in phlegmatic breasts, but to me the greatest interest was excited by the knowledge that ever since civilization extended over Europe this region has been the theatre of most of the grim human dramas, mostly tragedies, that the history has recorded. The stern barrier of the Alps offered a natural protection to Italy, which was long the cradle of civilization and the training school of the arts and sciences. Down these mountain passes which the railways now traverse, marched in the old days the Roman legions on their quest of conquest, and in the other direction for centuries afterwards marched the stalwart fair-haired races of the north, bound to take a share of the wealth and treasures which had been accumulating in every city of Italy and its islands. But whichever way the pendulum of war and conquest swung, the people who tilled the fields, pressed the grapes, turned wool into cloth and did every stroke of useful work performed on both borderlands of the Alps, were ground by the contending armies, like grain between two millstones.

As hour after hour we sit in the train, which twists round the edge of many giddy precipices, and goes through rockbound chasms and cuttings that we cannot number, the wonder grows upon us at the enterprise displayed in building such a railway some forty years ago. The great engineering feat of the route is Mont Cenis tunnel, so called erroneously, for Mont Cenis is nearly twenty miles to the east; but that is where the overhead pass is, and the railway people held on to the name of the route, even as the "Santa Fé trail" is given to parts of the Atchison, Topeka & Santa Fé that are far from the real trail.

Mont Cenis tunnel, begun in January, 1861, is 7¾ miles long, 26 feet wide and 19 feet high. It is a most substantial piece of work, being lined throughout with masonry. The drilling for this immense hole was done with compressed air, and was the first time that this method of transmitting power was employed for any great work. There is about 4,000 feet of mountain above the tunnel, and the center is 4,245 feet above sea level. The tunnel cost about $15,000,000. There is such stupendous work for miles towards both approaches of the tunnel, consisting of rock cutting, short tunnels, stone viaducts and protection walls, that the cost must have equaled that of the tunnel itself.

I was in a carriage with glass in the front, which enabled the inmates to obtain a good view of the railway and of the scenery. The roadbed is all ballasted with stone, and the single-headed rail is used, secured direct to the ties without the intervention of chairs. This is the same as American practice and is followed by many continental railways. They are using a good many steel ties all over Europe, the favorite form being an oblong steel trough with a lump squeezed up in the middle to resist lateral movement. On the railway divisions near the mountains, six-wheel connected locomotives are used for passenger service; but in other places eight wheels are almost universally used. In the locomotive works at Winterthur, Switzerland, I saw some mogul locomotives in course of construction, and the manager told me that that was becoming a favorite engine for mountain service, but I did not see any of them at work. The six-wheel connected engines had no truck, which must make them hard on wheel flanges, for the mountain roads are very crooked, some parts comparing favorably with the Baltimore & Ohio in this respect.

The ride from Geneva right through to Turin, in Italy, is throughout the whole route an ever-changing panorama such as I have never witnessed before in any other journey. There are hills and dales, moun-

SNAP SHOTS IN THE ALPS.

READY FOR THE MOUNTAIN GRADE.

A MOUNTAIN HELPER.

AN ITALIAN ROUNDHOUSE.

TRAIN FROM WINDOW OF LAST CAR.

tains, torrents, sylvan lakes, silvery rivers and dark-green forests. There are towns and villages with quaint old houses and churches without number, in some of which famous events had happened long before Columbus discovered America. There are chateaux, inns that look like old-fashioned fortresses, castles that look habitable for people who are not particular about personal comforts, and others roofless ruins. These latter seem to be in the majority, for their usefulness for defense has long vanished, and the owners no longer find them paying stock, so they are permitted to go to decay. The paying era of these structures was in the days when they gave refuge to a band of troopers who followed their leader to levy toll upon travelers and to stimulate the neighboring food-raisers to the paying of blackmail. No political organization ever began to equal the robber barons of auld lang syne in skill at making collections. The modern landlord may deal just as savagely with the tillers of the soil, but he seems to leave them enough to feed themselves and families; for nowhere in the country districts does one see distressing signs of poverty, and the people look well fed and decently clad.

As the train toils slowly up some of the valleys that lead to the main range of mountains, I frequently conjectured if anyone but the cultivator of the soil expected to take anything out of it. Are there landlords with rent rolls of farms that stand on end? Up the mountain sides, as far as grapes will grow, there are terraced vineyards, with wall upon wall built to keep the earth from slipping away. There does not appear to be an acre of land in the whole of Savoy capable of growing any useful thing that is not cultivated, and there are thousands of acres growing grapes and corn that none but a mountaineer could go over without danger of falling and breaking his neck. There are too many people for the size of the country. When one has traveled in Savoy and Italy he no longer marvels at the industry of organ grinding being overdone, and that the ash-barrels of American cities provide a subsistence to a considerable percentage of the community.

A striking thing about the Alps country is the number of torrents, streams rushing like Niagara River below the falls, dashing furiously against rocks and immense boulders, rolling down in a series of cascades, tumbling in the shape of waterfalls and everywhere redolent of activity, energy and power. A fair sample of this kind of stream is seen in the view of the entrance to the St Gotthard tunnel. It seems to me that the stream referred to could generate enough power to operate all the trains that pass through the tunnel. If the power of the thousand and one other streams touched by the railway were utilized to generate electricity, the whole of the road might be operated by that means. The rivers that rush out of many Swiss lakes, notably lakes Geneva and Zurich, might supply power to drive all the machinery in a large manufacturing town.

What strikes one as odd attachments to the ends of the Alpine tunnels is a battery of guns commanding the entrance. The French are ready to shatter at this critical point any invasion of Italians, and at the other end the Italians are ready with the same attentions for the French.

The Alps seem to be more rugged on the Italian than on the French side, for there are thirteen tunnels, besides several viaducts and bridges, in the first sixteen miles after we emerge from the southern end of the Mont Cenis tunnel. But the rugged part does not extend more than thirty miles, when we emerge upon a plain as flat as any part of Illinois. This is rich Piedmont (foot of the mountain), which, with Lombardy, the neighboring province, used to raise the food that supported Rome when the city was the heart of a great empire. Upon the rulers of the city fell the duty of feeding the populace, those who could not purchase food being fed at public expense. If modern large cities should adopt this policy, there would not be any trouble with overproduction of foodstuffs.

Although lower Piedmont reminds one of Illinois, the resemblance is confined to flatness. The fields in Italy look very different from our Western prairie land. We hear frequently recommendations given to American farmers to diversify their crops more than they do, and the diversity is supposed to lead to prosperity. This agricultual diversity has been worked up to the thirty-third degree in Northern Italy; for I believe the farmers raise every kind of produce that grows in the temperature zone. What strikes the observer in these parts is the number of people working in the fields. They do not use good farm implements, but they seem to make up for that in the number of laborers employed. They are mostly women.

As I was trying to count up the number of the different crops I had noticed in the twenty miles of level country, and had given up wrestling with a Frenchwoman to find out what they called "buckwheat" in her country, the train rolled into the station of Turin. The chief glory of Torino, as the Italians spell Turin, in my opinion, is that a city larger than Cincinnati has only one railway station. Two views of this fine building were given in the December issue of "Locomotive Engineering." In some respects this station was unique to me. In days gone by, the people in Catholic countries have delighted to devote their highest art to the decoration of churches. A common manifestation of this feeling was covering the walls and ceilings of churches with frescoes which are paintings done on a stucco ground. When the Stazione Centrala, as the station of Turin is called, was built, the people were sufficiently proud of it to decorate the waiting-rooms with frescoes, and very handsome they appear.

The station has the renown of having been built upon the site of a fortress built by the Romans long before the beginning of the Christian Era. Strange as it may appear, Turin is the most regularly laid-out city in Europe, and it owes this peculiarity to its founders, who built only one large rectangular block. In this case it was 2,210 x 1,370 feet, which comprised the city until the 17th century. When extensions were made, the streets were laid out parallel with the walls of the old city, and so a city of square blocks grew and prospered. The citadel that occupied the space where the station now stands was in the center of the ancient town.

In connection with Turin, the guidebook makes a note that reminds one of the grim fashion in which colonizing was done in days later than the time when the children of Israel were ordered to kill every human being found in the lands they were going to overrun. When Hannibal of Carthage crossed the Alps to invade Italy, he found Turin inhabited by a tribe of Celts. He destroyed them root and branch.

The antiquities, works of art, fine buildings and handsome streets make Turin a highly interesting city for the ordinary tourist. A man looking for things of a railroad nature has to be contented with the fine station and great workshops of the Mediterranean Railway. Particulars about the latter must stand over for another letter. A. S.

Where is the Microphone?

It is wonderful the number of inventions that are accepted by the engineering world, as promising to be great and useful, that come to nothing. Nearly every person connected with machines that have to transmit great power, has been impressed with the advantage it would be to have some method of testing which would show hidden flaws in steel or iron rods or bars. About ten years ago an instrument called the microphone was invented, which seemed capable of detecting hidden flaws in metals; yet we have never heard anything about what it has done, after being told in numerous articles what it would do. An experimental instrument was made, which detected the flaws in wires and small pieces of iron, and the inventor was willing to give the engineering world the benefit of what he had brought forth, but the engineering world seems to have treated the thing with indifference. If we remember rightly, an instrument to detect flaws in larger pieces could be made at small expense, and we are surprised that no effort has been made to apply it to the detection of flaws in axles and crank shafts.

Loss of Power in Shafting.

There appears to be a growing tendency among railroad companies to use the cheapest lubricating oils they can purchase. If an oil will keep a journal from running hot, no matter how much may be used to do the work, it is considered satisfactory—and the cheaper it is, the better. Those who follow this policy would do well to weigh carefully the results of a variety of investigations made by Professor Benjamin, of the Case School of Applied Science, Cleveland, to determine by actual observations in factories of various kinds, just what loss occurred through friction in transmitting power by belts and shafting from the engines to the driven machines.

The tests were made in sixteen different factories. During the daytime, when the works were in operation and the machines were running, indicator cards, showing the work being done by the engines, were taken each hour. Then during the noon hour, or at night, when the engines were driving only the shafting, similar cards were taken; and when these and the first ones had been averaged, the difference between the power required to drive the shafting alone and that required to drive the whole shop was found, and this reduced again to a percentage. The most startling loss was found in a bridge material factory, where the shops were spread over a lot of ground. Eighty per cent. of the engine's power was lost in the shafting there. In a planing mill the loss was 73 per cent.; in a sewing machine factory it was nearly 70 per cent. It was 77 per cent. in a stamping mill and 65 per cent. in a boiler and machine works. The average loss for heavy machine shops was found to be 62.3 per cent. The average for light machine work was 55.1 per cent., and in but one instance did the loss fall below 47.3 per cent.

In this one case the percentage of loss was so small that it must serve as a serious commentary upon the character of the work generally done in putting up shafting. This was in a steel screw works, and the loss was only 14.5 per cent. In this factory the machinery is all of the automatic type, very compactly arranged, and the shafting had been put up in the most careful manner. The shafting was in perfect alignment, and ran in hard cast-iron boxes without babbitt metal. It is supported by very rigid hangers, and was oiled by hand instead of wick oilers.

The results of these observations were presented to the American Society of Mechanical Engineers, at its recent meeting.

One explanation of the large loss by friction in many shops is the fact that economizing in either quantity or quality of oil has at once a favorable effect on the bills, while the corresponding increase in coal and water consumption may be unnoticed or attributed to other causes. This is a case of saving at the spigot and wasting at the bung.

Where the loss is due to a necessarily extended and complicated system of shafting, it would be wise to determine if electrical transmission of the power would not be cheaper in the end.

EXTRANCE TO THE GOTTHARD TUNNEL.

We learn from our friend, Mr. B. R. Lacy, Commissioner of the Bureau of Labor Statistics of North Carolina, that the Seabord Air Line made an extraordinarily fast run lately with a directors' special train. The run from Weldon, N. C., to Portsmouth, Va., a distance of 76.8 miles, was made in $72\frac{1}{2}$ minutes. This was subject to a reduction of about 5 minutes lost by reducing speed to run through towns.

Electrical transmission has been introduced into the Baldwin Locomotive Works, in the Long & Allstatter Company, at Hamilton, O., and in a great many other machine shops, with great saving of power. The discoveries made by Professor Benjamin ought to induce men in charge of railroad shops to find out for themselves how much power they are losing by friction. With accurate knowledge of the actual loss going on, they could figure intelligently on the improvements necessary, whether it should be in the form of improved methods of transmission or in the use of better lubricants.


EVOLUTION OF COAL MINE LOCOMOTIVES. Fig. 1.

Development of the Mule's Substitute.

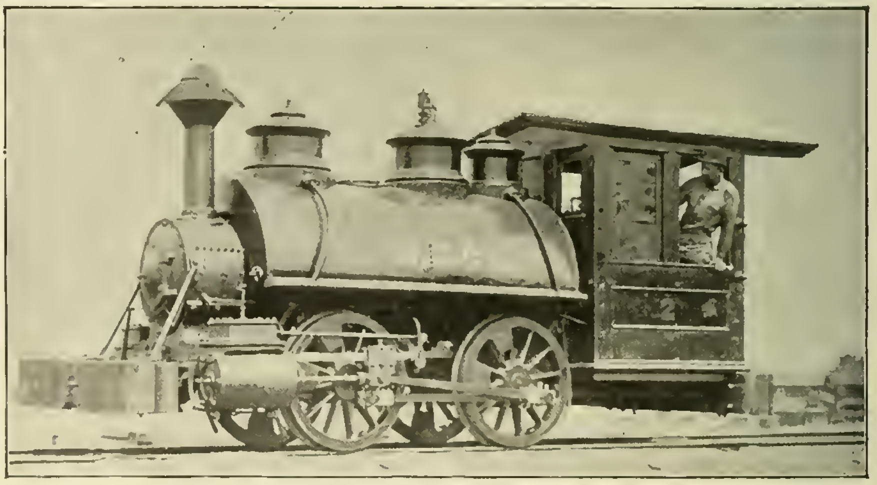
In the office of H. K. Porter & Co., Pittsburgh, makers of light locomotives, there is a series of photographs illustrating the development of power used in handling coal about the mines in Pennsylvania. We here reproduce the principal pictures.

First, in Fig. 1, there is the patient mule and the impatient driver, who is doing his best to keep up the speed of his train, but the method was faulty and too slow for enterprising people.

So the mule gave place to a small four-wheel locomotive, Fig. 2. This would haul the cars all right on the surface of the ground, but below, in the coal pits, the combustion gases were objectionable and the escaping steam was a nuisance.

Then electricity was tried and Fig. 3 was the form of motor brought out to chase the locomotive out of the field. It did not prove satisfactory and its reign was short.

The electric motor was succeeded by the locomotive driven by compressed air. Various kinds of these motors are built by the Porter Company, one being shown in Fig. 4. The boiler-like cylinder is an air reservoir, and there are two of them on each engine. They are considered particularly well adapted for mine work; but similar engines are in use on railways and yards where cotton and other inflammable material are hauled. They are growing in popularity and their use is extending.


EVOLUTION OF COAL MINE LOCOMOTIVES. Fig. 2.

Relative Value of High and Low Grade Coal.

Mr. C. M. Higginson, assistant to the president of the Atchison, Topeka & Santa Fé, who has been a very keen student of combustion problems, was applied to by one of our editors for his views on the relative economy of high and low grade coal for locomotive use, and he writes:

"The matter is not a simple one to decide. The course to be pursued on different roads varies according to the quality and price of the coal, the efficiency of the firebox and boiler construction in use, and the care that is taken in firing. If we had well-designed and efficient locomotive boilers, with intelligent firing we could probably afford to use the better-grade coals, at a price in direct proportion to their theoretical heating value as compared with poorer ones. In practice, however, the difference in price is often much more than the difference in heating value. Care should be taken, however, that the coal paid for should, even if of a low grade, be well inspected, so that it is a good representative of its kind and that the road should receive the grade of material paid for.

"In this connection it might be well to state that the question of burning different grades of coal will be a simpler one when we get better locomotive boiler designs in general use. The average locomotive is a very crude device as far as burning bituminous coal is concerned, as our mechanics and students have, as a rule, paid much more attention to steam-using than to steam-making. A larger proportion of heating surface to grate area than is often used is one direction in which we should make improvement, while another is increasing the flameway before reaching the tubes. When material improvement is made in these directions we will be in better shape to pay higher prices for higher-grade coals."

Tonnage Rating of Locomotives.

At the last meeting of the New England Railroad Club, the tonnage rating of locomotives and its effect on fuel consumption was discussed at considerable length. Most of the members who took part in the discussion expressed the belief that the method of rating tons by the number of cars had become obsolete, since the loads now varied from 20,000 to 80,000 pounds. Statistics of the work done by the consolidation engines running between Providence and New London were presented:

Engine No. 300 was observed during 30 round trips. The number of cars hauled was 2,404; loaded cars, 1,448; empty cars, 956; tons freight hauled, 21,690; dead weight hauled, 35,030 tons; pounds of coal burned, 314,300; engine mileage, 3,840; mileage for one round trip, 128; average number of cars per train, 24 loaded and 16 empty, total, 40; net tons of freight per train, 360; net tons of empty cars, plus weight of cars loaded, 600; average coal consumed per train of 40 cars for 64 miles, 5,236 pounds; average coal burned per ton hauled 64 miles, 546 pounds; average coal consumption per ton hauled one mile, 0.085 pound.

In this calculation it is assumed that the average car weighs 30,000 pounds. Fully half of the cars hauled were Pennsylvania, Lehigh Valley and Philadelphia & Reading cars that had a light weight of about 34,000 pounds. The others were home cars of about 25,000 pounds' weight; average of the whole 30,000 pounds. This was not a rating for those engines, only a comparative record of work performed and coal consumed. Those engines are capable of taking 50 loaded cars in either direction. Instead of hauling 40 cars they could have hauled 50 loaded cars, and that would have brought the amount of coal consumption per ton hauled lower. John Henney, Jr., the designer of the new engines used on the New York, New Haven & Hartford Railroad, believes that the size of the wheels has a good deal to do with the fuel consumption. His idea is that with a wheel that is too small, unless it is to run at a low rate of speed so there will be no slip, there will be quite a waste of fuel.

Indorsement of the Decimal Gage.

Through the united efforts of the engineering societies named in the resolutions below, the decimal system received its start as a standard for measurement of all materials used in metal construction. The support of the American Steel Manufacturers is a handsome recognition of the value of good work well done. These resolutions were adopted by the Association of American Steel Manufacturers, at its meeting in New York on October 23, 1896, and their full import is best shown by the solid array of well-known firm names:

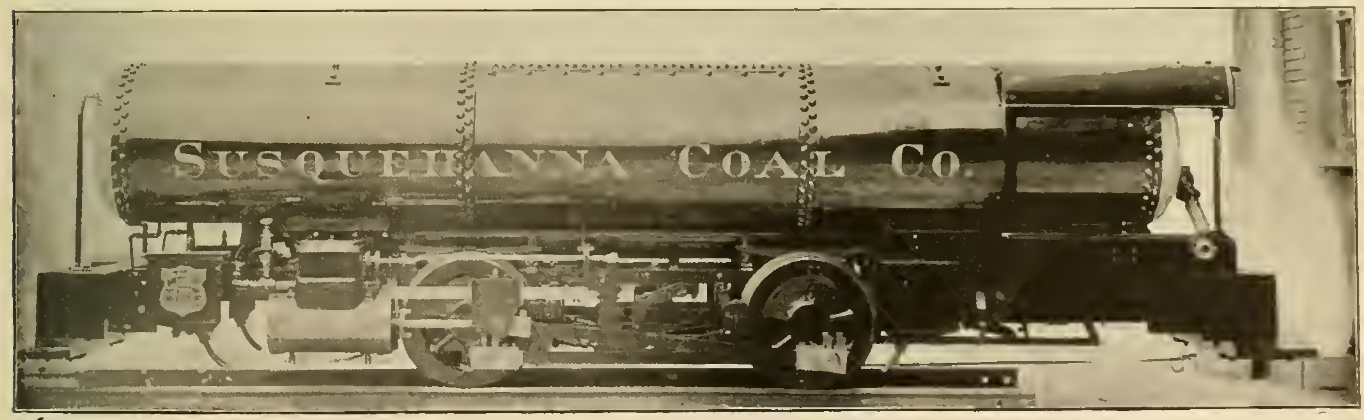
"1. Resolved, That we, The Association of American Steel Manufacturers, indorse the Decimal System as the proper Standard for measuring all materials.

"2. Resolved, That the Secretary be requested to forward a complete copy of the Committee's report, together with a copy of these resolutions, to the Secretaries of the American Institute of Mining Engineers; the American Society of Civil Engineers; the American Society of Mechanical Engineers, and the American Railway Master Mechanics' Association, as an evidence of the appreciation of the work accomplished by these societies towards the establishment of the Decimal System of Gaging, and as a proof of the hearty co-operation of this Association in this movement."

As an evidence that this indorsement of the Decimal System of Gaging carries considerable weight, the following list of members of the association is given in the letter of advice to this office:

The Bethlehem Iron Co., Cambria Iron Co., Carbon Steel Co., The Carnegie Steel Co., Ltd., Catasauqua Mfg. Co., Central Iron Works, Cleveland Rolling Mill Co., Colorado Fuel & Iron Co., Glasgow Iron Co., Illinois Steel Co., Jones & Laughlin, Ltd., Lukens Iron & Steel Co., Otis Steel Co., Ltd., Pacific Rolling Mill Co., Paxton Rolling Mills, Park Bros. & Co., Passaic Rolling Mill Co., Pennsylvania Steel Co., Pottstown Iron Co., Pottstown Iron & Steel Co., Reading Rolling Mill Co., Schoenberger Steel Co., Spang Steel & Iron Co., Worth Brothers.

EVOLUTION OF COAL MINE LOCOMOTIVES. Fig. 3.



EVOLUTION OF COAL MINE LOCOMOTIVES. Fig. 4.

In answer to the demand to perform all railroad mechanical operations automatically, Charles H. Hall, of Glidden, Wis., has invented apparatus for automatically sounding the whistle of locomotives at the points where whistling is necessary. The invention consists principally of beveled blocks secured alongside the track for the purpose of actuating apparatus designed to operate the whistle. The invention is quite elaborate and covers seven paragraphs of description.

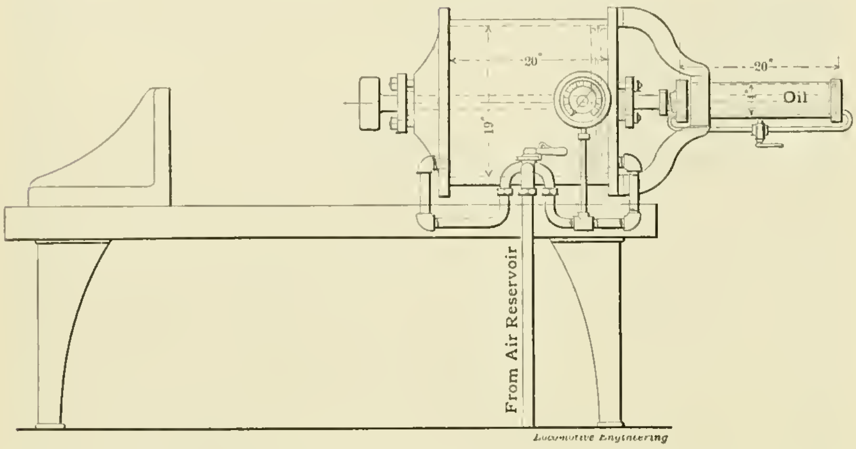
Horizontal Air Press.

An example of what can be evolved out of scrap material and made into a useful shop appliance, is shown in the accompanying cut of an air press made at the Sayre shops of the Lehigh Valley R. R. by Master Mechanic J. N. Weaver, who required a tool to use on bush work and to press driving-box brasses in and out.

The tool was made out of an old 19 x 24 locomotive cylinder, by cutting it off to 20 inches between joints and putting double-acting leather air-packing in the piston. The valve seat was planed off, and the wide face was then used to secure the cylinder to large cast-iron frame, slotted similar to a planer platen and mounted on legs at a convenient height to handle work.

In order to effectually eliminate all shock when pressing out work, occasioned by the piston being suddenly freed when the work let go, an auxiliary cylinder, 4 inches in diameter, was placed at the outer end of the large cylinder, from which the piston was made continuous. This small cylinder was filled with oil, and its piston had a small hole through it for the passage of the oil from end to end of the cylinder, as the piston displaced it when in action. The resulting movement of the ram was smooth enough thereafter.

An engineer's valve and air gage, when piped to the cylinder, completed a good tool that is always in commission. When we saw this press, an air lift was under way, to be placed immediately over it to handle the work, and is probably in full operation by this time. Mr. Weaver is more fortunate than most heads of division shops, in having a good air compressor to furnish the needful, and he takes full advantage of the situation by devising ways and means to utilize it.

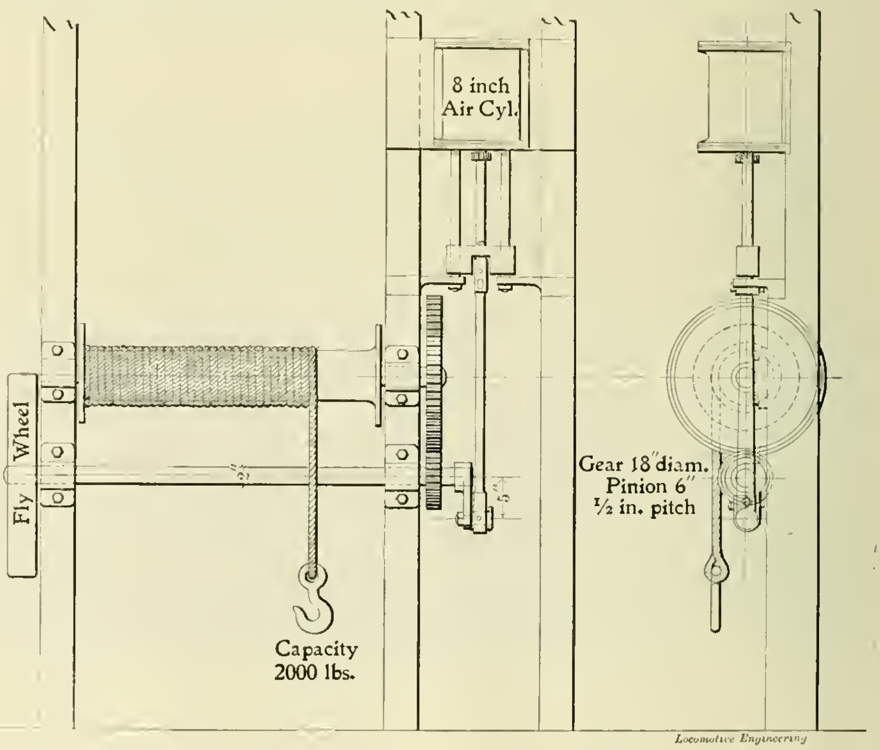


An Air Hoisting-Engine.

Mr. John Campbell, master mechanic of the Lehigh Valley shops at East Buffalo, N. Y., had long been annoyed by the difficulties attending the stowage of cotton waste and other material kept on the upper floor of the oil house, and set about to surmount the trouble at one fell stroke. How this was done is explained by our engraving of the device, which is nothing more nor less than an 8-inch Westinghouse air pump with the pump left off—the steam end and its reversing mechanism only being used, and compressed air taken for the power instead of steam.

Leather packing was applied to the piston, and guides, crosshead and main rod were fitted up, making a complete little engine, which, though wasteful of air, does not cause any serious loss, because of its intermittent use and short duration of service.

The main rod was coupled up to a crank on the same shaft, with a driving pinion, and motion was transmitted from the pinion to spur gear on the shaft of the winding drum. All the parts for this contrivance were picked up and put together to save labor, just as has occurred many times before and will continue to be done as long as power is needed to take the place of muscle. A way out of a difficulty is always provided for those who want to get out, but the transformation of an air pump into a hoisting engine is rare enough to deserve classification among the novelties. The machine has a lifting capacity of 2,000 pounds.



The Country's Rolling Stock.

The following information about railroad rolling stock is gleaned from the Report of the Interstate Commerce Commission:

"The total number of locomotives on June 30, 1895, in the employ of the railways of the United States was 35,699, being an increase of 207 over the previous year. The average annual increase since 1890, including the year covered by this report, is 1,112.

"The number of cars in service of railways on June 30, 1895, was 1,270,561, being a decrease of 7,517 as compared with the previous year. The decrease in cars assigned to freight service was 9,050, passenger cars showing an increase during the same period of 94, and cars assigned to the company's service an increase of 1,439. It cannot be said that this decrease in freight cars is due entirely to an effort on the part of railways to economize in equipment, for, as is shown by subsequent summaries, freight traffic and freight-train mileage have both increased during the year covered by the report, while the average length of haul per ton has decreased. The true explanation of this decrease in the number of cars assigned to freight service is found in the increased use which railways make of private cars. Reference has frequently been made in these reports to the fact that the existing law does not enable a complete compilation of railway equipment. This must be constantly held in mind in order to avoid erroneous conclusions. It was stated in last year's report that 'the railway management made the slackness in business the occasion for destroying a larger number than usual of old cars and cars of an inferior type.' It is possible that this may have influenced somewhat the changes in equipment during the present year, but there is no evidence in the correspondence pertaining to the present report that the decrease in freight cars shown in the above summary can be explained in this manner.

"The number of tons carried per freight locomotive in 1895 was 34,817, being an increase of 2,908 over the corresponding figures for the previous year. The number of ton-miles per freight locomotive was 4,258,821, being an increase of 242,066 over the corresponding figures for the previous year. These figures show increased economy in the transportion of freight. The same result is shown by the fact that 1,717 freight cars were required to move 1,000,000 tons of freight in 1895 as against 1,888 in 1894; but, as already pointed out, these figures are not satisfactory, because so large a portion of freight is moved in cars not owned by railway corporations, and consequently not included in the basis of these computations.

"Out of a total of 1,306,260, only 362,498 locomotives and cars were fitted with train brakes, and 408,856 with automatic couplers. The increase in equipment fitted with train brakes during the year covered by the report was 31,506, and the increase in equipment fitted with automatic couplers was 51,235. While these figures are considerable in themselves, they do not indicate a rate of improvement which will satisfy the conditions of the law.

"The number of passenger locomotives fitted with train brakes on June 30, 1895, was 9,876, being an increase of 106 over the corresponding figures for the previous year. It appears that practically all passenger locomotives are fitted with train brakes, while the increase in the number of passenger locomotives is exactly the same as the increase in the number fitted with train brakes. The number of freight locomotives fitted with train brakes on June 30, 1895, was 16,712, out of a total of 20,012 freight locomotives. The increase in freight locomotives fitted with train brakes during the year covered by the report is 729, being 717 in excess of the increase in locomotives. The number of passenger locomotives fitted with automatic couplers on June 30, 1895, was 3,893, being an increase of 414 over the previous year. By comparison with the number of locomotives in service, it appears there yet remain 6,106 passenger locomotives without automatic couplers. The number of freight locomotives fitted with automatic couplers on June 30, 1895, was 2, 039, being an increase of 731 over the previous year. When, however, it is remembered there are 20,012 locomotives in service, the deficiency in this regard becomes apparent.

"The number of passenger cars fitted with train brakes on June 30, 1895, was 32,384, being a decrease of 19 as compared with the previous year. The number of passenger cars in service was 33,112. The number of freight cars fitted with train brakes on June 30, 1895, was 295,073, out of a total of 1,196,119 cars assigned to the freight service. The number of passenger cars fitted with automatic couplers on June 30, 1895, was 31,971, out of a total of 33,112 cars in the passenger service. The number of freight cars fitted with automatic couplers at the close of the year covered by this report was 366,985, out of a total of 1,196,119 cars assigned to the freight service. The passenger service, both locomotives and cars, seems to be fairly well equipped with automatic appliances. Much remains, however, to be done in the case of the freight service."

Caledonian Suburban Engine.

The locomotive here illustrated is one of a class recently designed by Mr. John F. McIntosh, locomotive superintendent of the Caledonian Railway, for handling the suburban traffic in and around the city of Glasgow. The trains handled are similar in weight to the trains pulled on our elevated railways, and this new engine does the work very satisfactorily. It is much smaller than the locomotives usually employed on suburban service in Great Britain, but it is quick and powerful, with plenty of weight on drivers to prevent slipping. The men running the engines say they are the handiest and best engines to handle that the company ever owned.

CALEDONIAN SUBURBAN ENGINE.

A track foreman of Hibernian origin was called upon to give evidence at a coroner's inquest on the body of a man found dead on the line, and was told by his inspector to be careful in doing so. Asked by the coroner if he knew the deceased, he replied, "No, sorr." "Did you ever see him before?" "Niver, sorr." "Then he was a complete stranger," continued the coroner. "Not at all, sorr," was Pat's reply. "Why, what do you mean? You said just now that you had never seen him before!" "Nayther I had, yer honor; but when I did say him, he was a very incomplate stranger, ez wan of his legs and wan of his arms wiz off him."

The Thomas Pneumatic Switch and Signal System.

Through the courtesy of J. W. Thomas, Jr., assistant general manager of the Nashville, Chattanooga & St. Louis Railway at Nashville, Tenn., we are enabled to place before our readers the description and illustration of a switch and signal system operated by compressed air exclusively. We quote from Mr. Thomas' description as follows:

"The fundamental feature of this system is the manipulation of the valves admitting compressed air to and exhausting it from the working cylinders of railway signals and switches by means of pistons of the equalizing type. The pressure must be increased or decreased suddenly, otherwise the equalizing pistons will not be actuated. To throw a switch, get an indication, or place a signal at safety position, an increase of pressure must be had in the pipes. A reduction or increase of pressure caused by a leaky slide valve will not actuate these pistons. To demonstrate this, one of each of the slide valves was made to leak very badly, the leak being very much greater than if valve was permitted to run for years without attention. In each instance the increase or reduction of pressure caused by such leaks failed to actuate the equalizing pistons.

"The apparatus needs no delicate adjustment; the pumps have been stopped and the pressure allowed to fall to 50 pounds before the switches and two-position signal would fail to respond. The three-position signal refused to leave its danger position when pressure had fallen to 60 pounds. All signals can be put to danger, even if pressure should fall as low as 4 pounds. A ¼-inch cock may be left wide open on the controlling or indication pipe of a signal 1,000 feet away, and even with this leak, signal and its indication will respond promptly.

EXPERIMENTAL PLANT, BEEN IN OPERATION TWO YEARS.

SWITCH OPERATING FOR THREE YEARS WITHOUT SINGLE FAILURE.

"Home and distance signals can be handled with the same lever, the indication being so arranged that lever cannot be fully reversed unless both signals go to safety, and that lever cannot be put near enough towards its normal position to unlock conflicting levers unless both signals go to danger. To interlock the levers of the machine, the beveled type of locking is used; hence, if lever cannot be fully reversed, it locks all levers with which it is interlocked.

"Assuming that it is more important to know that a signal resumes its danger position than it is to know that it goes to safety, the indication for signals has been arranged so that an increase of pressure must take place in the indication pipe before the lever operating the signal can be brought near enough to its normal position to unlock conflicting levers."

Four years ago Mr. Thomas conceived the idea of handling railway switches and signals with air, and without the aid of hydraulic or electric appliances. After an innumerable number of tests with various pressures and different sizes of pipe, he finally settled upon 70 and 80 pounds as the proper pressures, and found that air could be handled more quickly through ¾-inch pipe than through any other size or combination of sizes.

About a year after these experiments began he was able to handle switches and signals very nicely, and determined to put up an experimental plant. This plant was completed two years ago, and consists of eight levers, handling one cross-over, two single switches and seven signals. Photograph A shows this plant with the exception of a distant signal, which is placed 2,000 feet from the tower.

One of the switches is 250 feet from the tower, another 750 feet, and the cross-over 500 feet.

The top blade of the two-arm mast is

REAR VIEW OF TWO-POSITION SIGNAL.

500 feet from the tower, the bottom blade is 120 feet away, the distant signal for top blade is 1,000 feet, home signal nearest on photo is 750 feet, the three-position signal 300 feet, and the dwarf signal is 350 feet away.

Notwithstanding the fact that this plant has been roughly used and has been given little or no attention, it is in perfect working order and has more than fulfilled expectations.

With the thermometer at 10 degrees below zero, no trouble whatever was experienced with ice closing up the ports or passages, or causing the equalizing pistons to stick. A careful search was made, but not the slightest particle of ice could be found in any of the valves, ports or passages. With yard flooded with water to the tops of the ties, the switches and signals responded without interruption.

TWO-POSITION SIGNAL, SHOWING SIGNAL INDICATION VALVE.

Photograph B shows a switch which has been handled three years without a single failure.

Photograph C is rear view of two-position signal.

Photograph D is front view of two-position signal, showing signal indication valve. It will be noticed that there is a little whistle on the side of this mast which has been rigged up temporarily with a chain. The whistle blows as long as the signal is at danger, thus giving an audible as well as a visible signal.

Photograph E is the dwarf signal, 300 feet from the tower. It can be operated in 1 second. Indication can be gotten in .1 of a second. The time from first movement of the lever to receipt of indication is 1.1 seconds.

Mr. Thomas is putting in between the city and his shops six pneumatic interlocking plants as follows:

Cedar Street—20 levers, handling 9 switches and derails, 14 signals and 4 spare spaces.

Line Street — 19 levers, handling 9 switches, 13 signals and 1 spare space.

Clay Street—43 levers, handling 5 cross-overs, 8 switches, 27 signals and 3 crossing gates.

Park Street—16 levers, handling 3 cross-overs, 1 switch, 10 signals and 2 crossing gates.

Bostick Street—28 levers, handling 5 cross-overs, 2 switches, 16 signals, 4 crossing gates and 2 spare spaces.

Shop—24 levers, handling 5 cross-overs, 2 switches, 15 signals and 2 spare spaces.

Two 18¼ x 18-inch Ingersoll compressors at the shops convey the air to Cedar street, two miles distant, by means of 3-inch galvanized pipe laid in vitrified clay pipe; ¾-inch galvanized pipe is used for controlling and indication pipes. He expects to put Line and Park street towers into service about January 1st, and the others as fast as they can be completed.

Mr. Thomas has always laid great stress upon the necessity for simplicity in the apparatus, there being no springs nor delicately adjusted parts to give trouble. All he uses is plain everyday slide valves, 3½-inch equalizing pistons fitted with snap rings and provided with small ports through which the pressures equalize, pipe, pipe fittings, cast reservoirs, operating cylinders fitted with leather packing, and the pressure-reducing valve at each tower for his leakage system. The equalizing valves are made very much upon the same principle as the plain triple. They have been run for two years without the slightest attention, and as they will not receive the same amount of hard usage given the air-brake triple valves, they should, therefore, last for years.

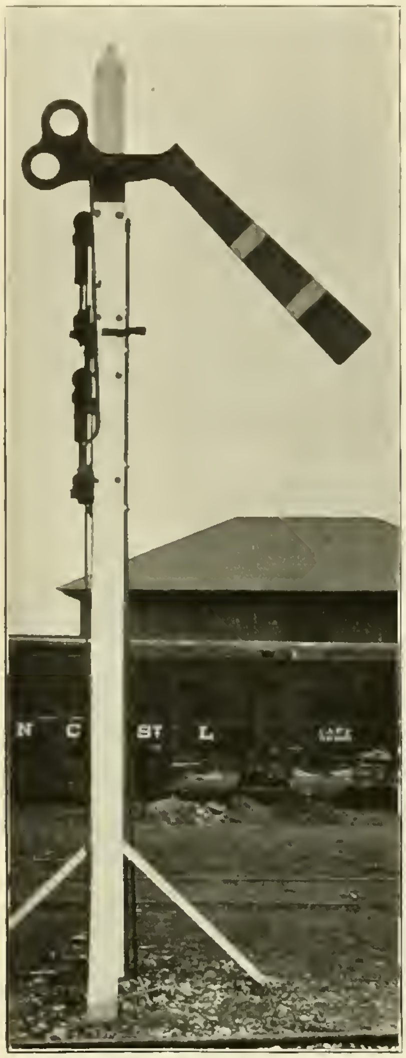
Any ordinary machinist should be able to get a comprehensive idea of the system within an hour's time.

For interlocking the levers he uses miter locking. For special locking he uses an appliance of his own invention. The entire apparatus is covered by letters patent.

Concerning this system of interlocking, Mr. Thomas says: "I am frank to confess that the first cost and cost of maintenance is more than for the mechanical system; but it must be remembered that with the latter system no indication is had. The system we are putting in is, in my opinion, much cheaper than the hydro-electro-pneumatic, the electro-pneumatic, or the electric. In the first place we do away with all hydraulic and electric apparatus, and I believe we can put down a ¾-inch pipe as inexpensively as a properly pro-

DWARF SIGNAL, CAN BE OPERATED SIXTY TIMES PER MINUTE.

tected and insulated wire can be laid. Leakage from electric street-car systems, and the fury of electric storms, have no terrors for us. We do not have to wait for the equalization of pressures, as the air in the controlling pipes is not used to handle the switches and signals, but



THREE-POSITION SIGNAL OPERATED WITH ONE LEVER.

run a separate pipe from the main supply; hence it is that we are able to handle a switch 250 feet away, 28 times a minute. We have handled a signal 1,728 times without stopping, an operator handling lever just as fast as he could, and the only reason that he quit was that he got tired."

Below is given the time consumed in operating switches and signals, including indications for same:

SWITCH.

100 feet away	0.8 seconds
250 "	1.05 "
500 "	1.75 "
750 "	2.5 "
1,000 "	3.1 "

SIGNALS.

100 feet away	1.25 seconds
300 "	1.1 "
350 "	1.34 "
500 "	1.91 "
1,000 feet away	3.07 seconds
1,500 "	4.00 "
2,000 "	5.56 "

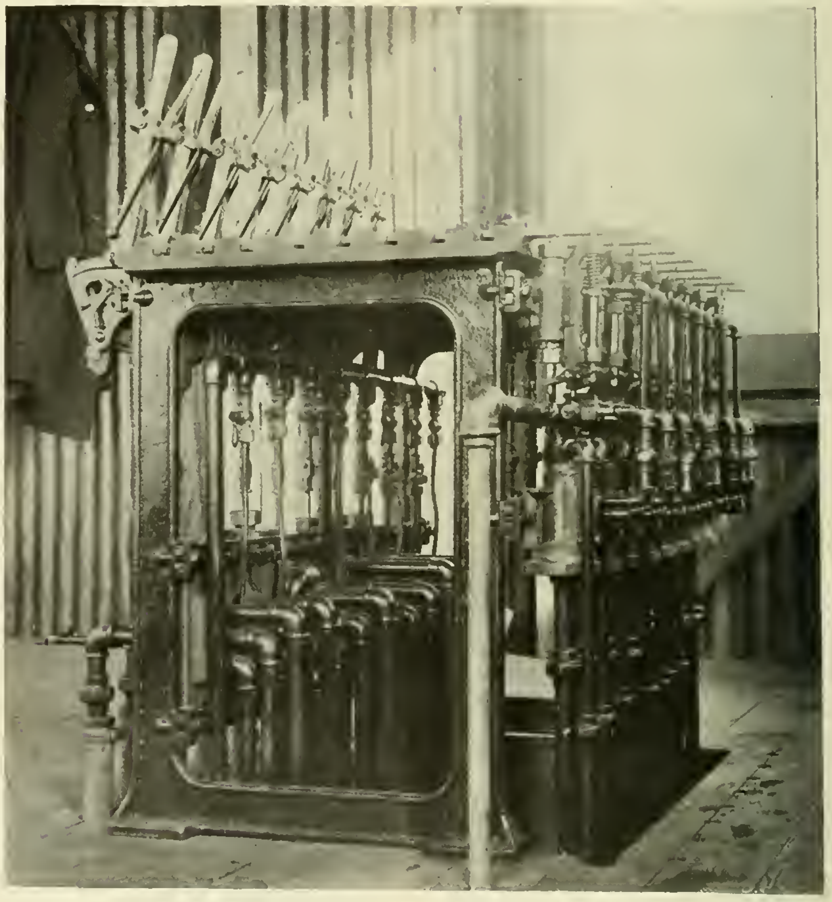
It is not necessary to wait for pressure to equalize. By actual test, a switch was handled as follows:

	250 feet away	28 times per min.	
	500 "	20	"
A signal	300 "	28	"
	1,000 "	28	"

The passenger and freight yards are located at Cedar street, and Mr. Thomas expects to use air from the main to test brakes, clean cars, etc. He is also arranging to equip his shops with pneumatic tools, etc., and the compressors will, of course, furnish air for them.

Mr. Thomas is the inventor of the only purely pneumatic system for operating switches and signals. The unerring accuracy and surprising speed attained in the development of this system records another notable achievement for compressed air. Yet no more remarkable is the adaptation of this fluid to another useful and highly important purpose than is the energy and capability of the man whose technical knowledge of railroad matters qualifies him to design and develop such a system, meanwhile performing his routine duties of directing from a high executive office the operation and business affairs of a large railroad.

A committee of the Western Railway Club has been investigating recent developments in the tonnage system of rating locomotive performances, and has made a report on the same. They make several recommendations calculated to make it easier to find out the actual tonnage hauled. Several railroad companies have adopted the ton-mile system of showing locomotive performance, but the results have been by no means satisfactory. We have talked to several leading superintendents of motive power on the subject, and we see very little prospect of ton-mile rating coming into general use. Most of them say that there are serious objections to the ordinary car-mile system; but when attempts are made to change to the ton-mile, complications arise which make the system worse than the old one. They all agree, however, that the agitation in favor of ton-mile rating has had the effect of directing the transportation departments to the number of partly loaded cars passing over nearly all lines. The result has been that there is a material increase in the average car-loads within the last year.



EIGHT-LEVER MACHINE IN EXPERIMENTAL PLANT.

We have on hand twenty-four bound volumes of 1894, that are in the way. Will mail one to any address for $1 (just enough to cover cost of carriage). First come, first served.

Punching Machine.

The accompanying engravings show a machine for punching a series of holes simultaneously at a single stroke of the punch. It was designed by Mr. Jas. Long, foreman of the Lehigh Valley Railroad shops at Packerton, Pa. Fig. 1 is

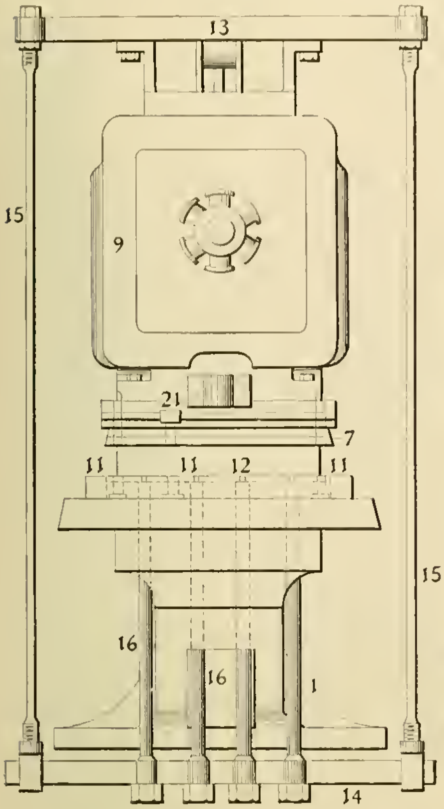


Fig. 1

a front elevation of the machine; Fig. 2 is a side elevation of same; Fig. 3 is a transverse section on line *x x* of Fig. 5; Fig. 4 is a face view of the punch block, detached from the machine; Fig. 5 is a side elevation of the punch block, also detached; Fig. 6 is a face view of the punching die and guide plate, which guides the punched wads or blanks to the openings in the punch block; and Fig. 7 is a longitudinal section on line *y y* of Fig. 6.

The numeral 1 indicates the frame of the machine, which is formed with upper and lower jaws 2 and 3. The upper jaw is provided with vertical ways 4, between which is arranged a reciprocating ram or plunger 5. At the lower end of this plunger the punch block 6 is secured, and has on its lower face the plate 7, which is provided with apertures 8, equal in number to the holes to be punched.

The lower jaw 3 forms a seat for the die 10, which is provided with a series of punches 11, which are also equal to the number of holes to be punched and are in alignment with the apertures in plate 7. A lifting plate is indicated by the numeral 12, and also has holes through which the punches 11 pass. The plate 12 has a vertical movement within a recess in the upper face of die 10, and is raised and lowered by means of vertical columns 16, which pass through the plate and are riveted over at the top, the plate bearing on shoulders formed on the columns 16.

In operation, the object to be punched is placed on the die 10, and the punching block is then forced down, which carries the work against the punches, the latter passing completely through. The wads or blanks removed by the punches are forced upward through the apertures in plate 7, and are discharged through the passages 20 and 21. After the punching is completed and pressure removed, the lifting plate rises and strips the work from the punches, when the machines is ready to punch another piece.

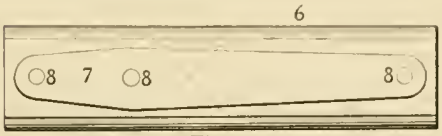


Fig. 4

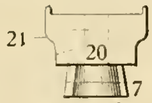


Fig. 3

Fig. 5

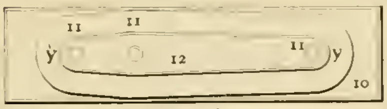


Fig. 6

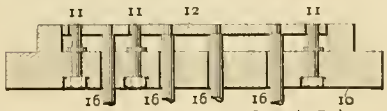


Fig. 7

The engravings show the machine rigged with punch and die for brake-lever holes. This specimen of work, to illustrate the capabilities of the device, is well chosen; for the importance of having the holes in brake levers absolute duplicates in spacing for a given standard of leverage, is too little understood or appreciated. Mr. Long has had this machine in operation at the Packerton shops for some time, where it can be seen doing fast first-class work by any who are interested.

The Trethewey Manufacturing Company, Pittsburg, Pa., builders of steam hammers and heavy punches, shears and hydraulic tools, are now making shears for cutting 1¼-inch steel boiler plate. They have recently received several orders from abroad for their heavy shears.

One Eye Better Than One and a Half.

There appears to be as much friction between British railway companies and their employés on account of examination for defects of vision, as there was in this country when the practice was first started, and there are peculiarities to the British system of examination, which are all their own. A protest was recently brought before the Board of Trade by the Amalgamated Society of Railway Servants on what seems to us to have been a curious case. The Caledonia Railway Company had been testing the sight of their drivers and firemen. Three drivers and two firemen were able to pass successfully with one eye, but failed to count spots correctly with the other. The men were, in fact, found to be short sighted in one eye only, and on that ground were taken off their engines and removed to the workshops, where they were employed on lower pay. At the present time there is an engine driver at work on the road, who has only one eye and he is permitted to remain on duty. Contention was made by the society that a man with an eye and a half, which is about equal to what the men rejected had, was in a better position to see correctly than the man who had

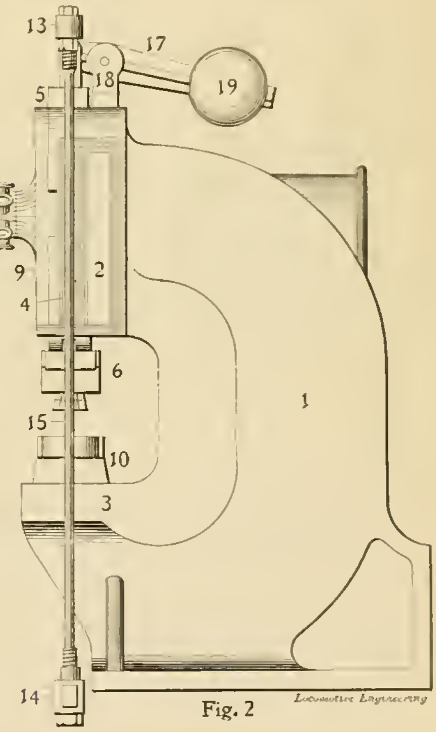


Fig. 2

only one eye. We have not heard of a decision being made, but it is certainly a very peculiar case.

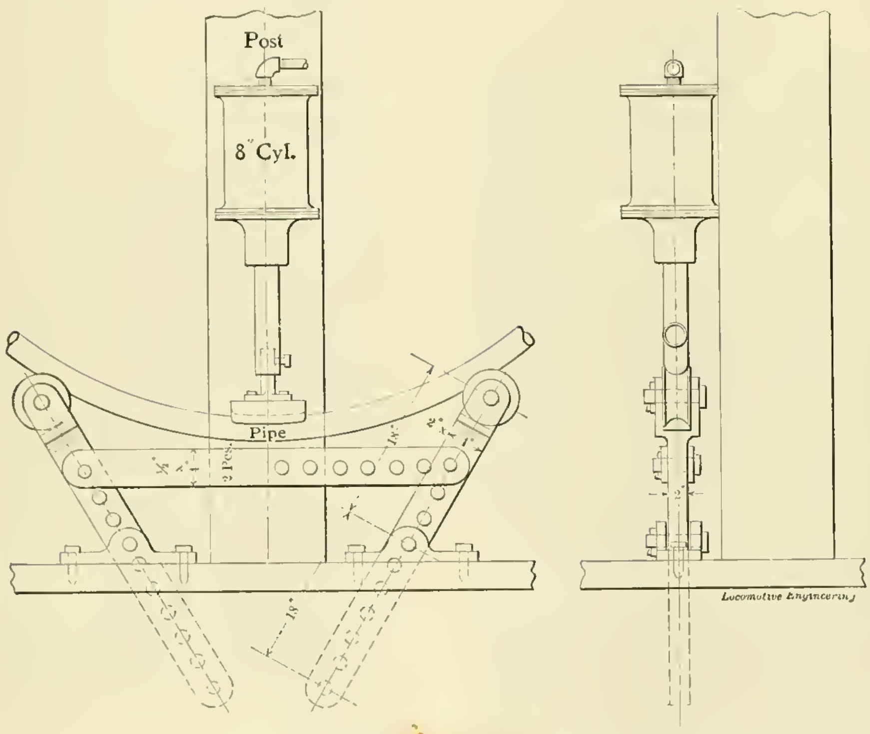
It is reported that the Russian Government intend to use chilled wheels largely for freight cars on the Government Railways, that are under construction to the Far East.

A Pipe-Bender.

Among the various schemes for bending pipes to the curves required in piping an engine or car, the one long in use at the Wilkes-Barre shops of the L. V. R. R., and which we illustrate herewith, will be found a more simple rig for the purpose than many that have been shown heretofore.

In the development of his air devices, Master Mechanic Roth had to face the need of a pipe-bending machine, and he tackled the problem in his usually original way, producing a cheap and very efficient arrangement that will bend any size of pipe to any radius.

The whole thing consists of an old 8-inch air-cylinder secured to a post, and two levers pivoted in castings fastened to the floor. The levers have a grooved



roller at their upper ends, in which the pipe is laid in the bending process, and the former are adjustable to any angle in a vertical plane, by means of a pair of tie-bars, which secure them in any position, with the rollers near to or remote from each other; the levers passing through the floor, and are raised or lowered at will to meet the varying conditions of bending pipes to different radii.

Here is a solution of the pipe-bending problem in its simplest form; the machine embracing so few parts, and the degree of roughness at which these parts can be put up, makes the cost an item that should not have serious consideration by those who have an air plant and want a good machine to do pipe-bending.

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Two improvements on car seats have been patented by Mr. Henry S. Hale, of Philadelphia, the senior partner of the firm of Hale & Kilburn.

Curious Method of Compressing Air.

There is a curiosity to be seen at Magog, a village near Montreal, Canada, where the machinery of cotton mills is driven by compressed air obtained in an odd way. A stream of running water is used to do the compressing of the air, and the surprising feature of this arrangement is that no machinery whatever is employed in doing the compressing.

It is done by a singular application of the principle of induced currents; the running water falls into a deep shaft, and a variety of small air pipes are led down from above into the falling current of water. The water naturally sucks in the air, which is mixed with the falling mass. At the bottom of the shaft is a cone similar to the cones used in diamond smoke-stacks. The water falls on this and is dashed into spray, releasing the air. Return pipes are provided for the flow of the water and it goes away in one direction, and the air passes up from the air chamber through pipes provided for the purpose. The degree of pressure secured is regulated by the height of the return water level above the bottom level of the inflowing shaft.

The principle has been applied on a small scale before for compressing air, but we do not think it was ever used for driving a factory. In books on ancient machinery, this method of compressing air is described and is called a "trompe." It was used for compressing air used in furnaces and forge fires. It is mentioned by Pliny (A. D. 76), and Kircher in his "Mundus Subterraneus" (1665) gives a figure of it, and in his "Musurgia Universals" he shows his application to the blowing of organs, in which, however, he is anticipated by Branca (1629), whose illustrations represent it as blowing organs and also forge fires.

Although used for various purposes during the seventeenth and eighteenth centuries, the introduction of steam seems to have put the "trompe" into desuetude, but it has been applied to practical uses in a few instances within the last twenty years.

In a communication to the "American Machinist," Mr. W. F. Durfee said that in the year 1869 he designed a modification of the "trompe" for use as a vacuum pump and table blow pipe. This was believed at the time to be the first use of the principle of the "trompe" for exhausting air; but, as a matter of fact, Professor Bunsen had employed this principle in construction of his filter pump a few years before. Mr. Durfee also fitted up a "trompe" for compressing air in the laboratory of the steel works at Wyandotte, Mich. The apparatus seems to provide a very convenient means of transposing the power of running water into the air medium of transmission of power, that is much more convenient than water.

❀ ❀ ❀

A report has been made to the British Board of Trade about the accident to a passenger train which happened at Preston during the summer, and which was illustrated in our September number. Our readers will remember that there was going to be train-racing between the East and West Coast roads last summer, and the various railway companies comprising the rival routes had prepared for victory by designing and building extremely fast locomotives, but this accident put an end to it in the start. The report on the disaster summarizes the causes as follows: "A reverse curve without any intervening tangent, without check rail, with super-elevation suitable only for very low speeds and badly distributed, and with a radius at one part of only seven chains; a train drawn by two engines, each having a rigid wheel base of 15 feet 8 inches; and lastly, a speed of 40 miles an hour or more, form a combination of conditions which were almost certain to lead to disaster."

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Some improvements going on in connection with the Baltimore & Ohio Railroad at Baltimore recently, required that a large freight warehouse should be moved. At first it was thought that the building would have to be taken down and rebuilt, but the department of buildings conceived the idea of moving it bodily, and the feat was successfully accomplished a short time ago. The building is 440 feet long by 120 feet wide and 60 feet high. Besides its own weight, the building contained a great quantity of freight, among which was 3,000 cases of china and crockery. The moving was performed in five weeks, and no perceptible damage was done to the structure.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Steel Car Trucks--Passenger and Freight.

There has been for some time past considerable thought given to designs for steel car trucks, in which the well-known conventional lines have been deserted for various forms in which the details were at wide variance with old practice. The goal which all aimed to reach was apparently to be gained only by a total abandonment of the arch bar, and with a frame which was practically solid and continuous between the wheels.

The possibilities of a plate frame to reach this result were quickly recognized, and from that form of construction it was only a step to a composite frame made up of rolled sections in combination with a web plate, and the whole securely riveted together to form the complete frame.

Two trucks of the latter type are shown herewith; one for passenger service and one for freight. The same general idea of using easily obtainable commercial shapes in the framing has been worked out in both cases. Fig. 1 is the passenger truck in elevation, plan and sections. The upper and lower sections of the side frame consist of angle bars arranged in pairs, with the web plate extending between and riveted to them. Two half-elliptic springs rest on each box, and sustain the frame by bearing against suitable seats under

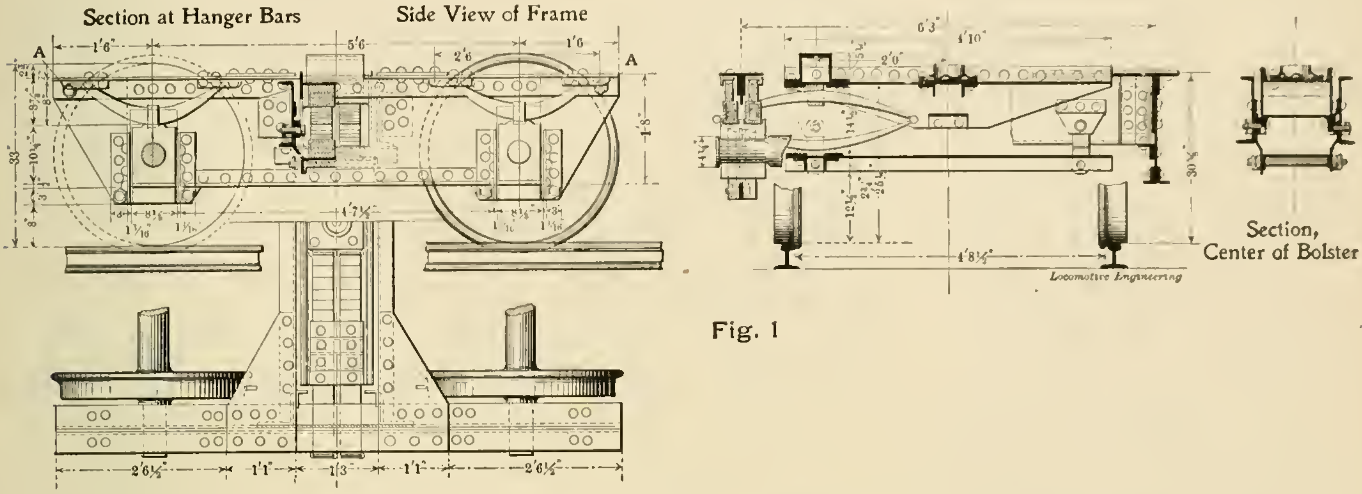


Fig. 1

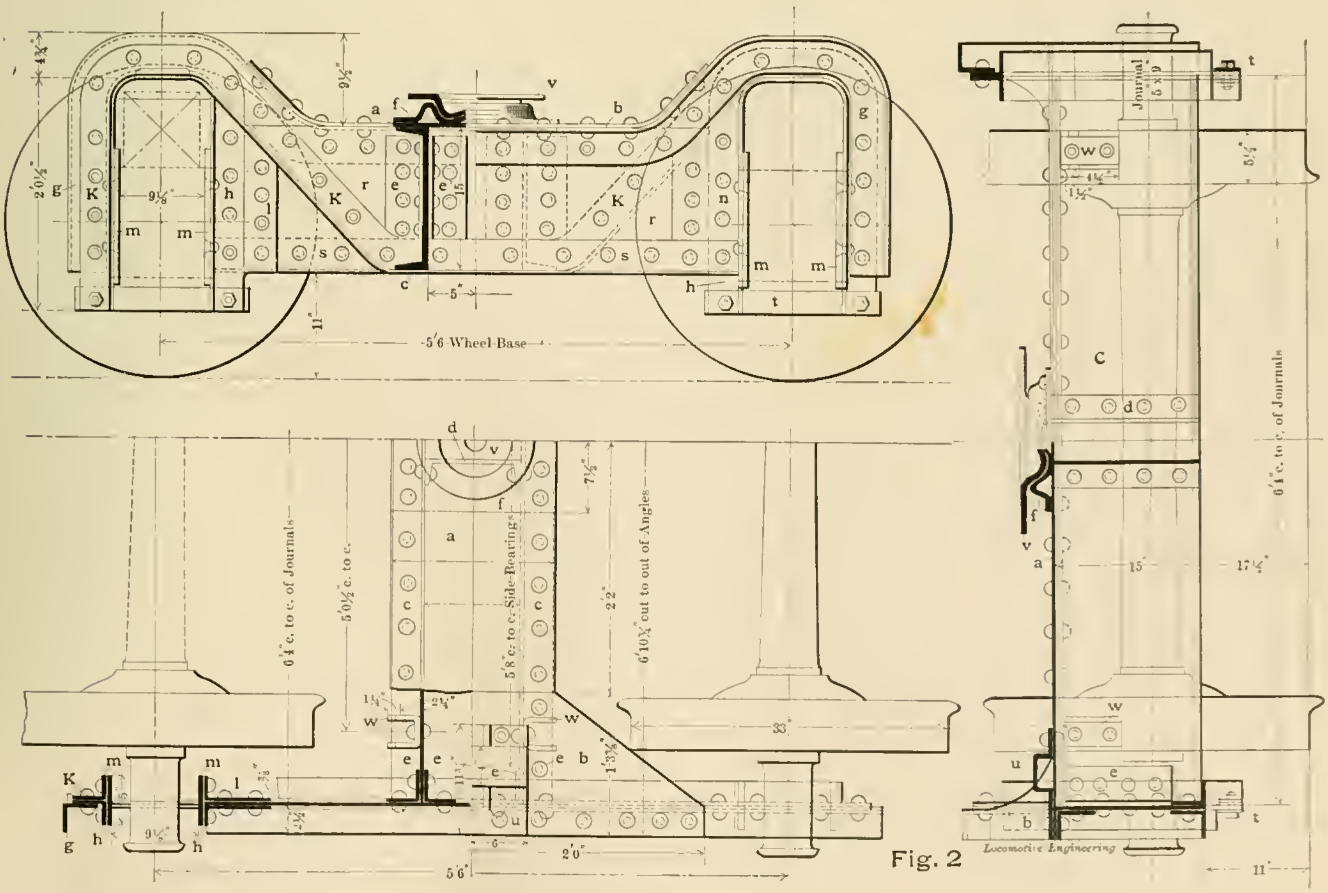


Fig. 2

A NEW STEEL TRUCK.

each upper angle, one outside and one inside.

Jaws for the journal boxes are made of angles, also riveted to the web plate, and to the faces of these angles are riveted chafing pieces, readily removable to compensate for wear. At the center of the web plate an aperture is cut to allow the bolster springs to pass through. The transoms, formed of two channels, are secured to the plate of the side frames by two horizontal angles, which support the transoms at a point just above the lower frame angles, and in addition to this, the transoms are riveted to short vertical angles, which are in turn riveted to the plates of the side frames.

A channel extending across the truck and parallel to the transoms, forms the lower spring seats. This channel is supported in the usual way on swing hangers, from the inside of the transoms. The truck bolster is made of one long channel at the top with flanges extending upward, and one short section of channel at the bottom in the center of its length, to which are riveted a plate at each side.

To resist distortion of the truck frame, and to hold in check any tendency to disturb a proper alignment of the parts, there are gusset plates secured to the upper flanges of the transoms and the top angles of the side frames.

Provision is made to swing the outer section of the frame which forms the jaw (if that form of construction is preferred), for the purpose of removing the wheels and axles endwise. This is accomplished by means of the bolt at *A*, which forms a hinge and allows the ends of the side frame to swing up and out of the way when the tie-bolt under the journal box is removed. Failure to provide for removal of wheels except by the jacking process has been a weak feature in trucks of this character, and all objections in this line appear to have been met in the truck under consideration, it only being necessary to lift the truck high enough to relieve the frame springs of their weight.

Fig. 2 is a freight truck of 100,000 pounds capacity. The frame in this case is made up of an angle bar *g*, horizontal for a portion of its length at the center, bent upward to form the jaw for the journal box, and again bent downward at the ends so as to be a part of the outer pedestal jaw. To the vertical flange of this angle is riveted the plate frame, which extends the whole distance between jaws horizontally, and from the upper to the lower angles of the frame. The jaws are formed of an angle bent to an inverted U, which incloses the three sides of the jaw.

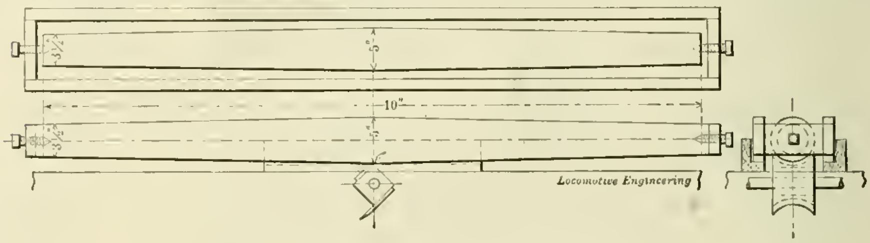
An angle bar *k*, extending the length of the side frame, has its ends passing over the top and down the outside faces of the jaws. It is bent down in its central portion, forming a support for the bottom edge of the transoms, which are made of 15-inch channels, extending across the truck from frame to frame, and secured to the latter through short vertical channel sections. At the ends of the transoms are strengthening plates riveted to the top of transoms and to the angles *g*, contributing to the end of having the truck a rigid one in every particular.

The aim of the inventor of these trucks, Mr. F. H. Kindl, of Pittsburgh, Pa., has been evidently to avail himself of every advantage to be had in the use of commercial rolled shapes, and thus obviate the necessity of expensive manipulation in construction.

Quick Way to Make a Push Pole.

Push poles for yard engines are usually turned in a lathe, but Superintendent of Car Department Leutz, of the Lehigh Valley Railroad, has a scheme in vogue at his Packerton shops, for getting the rough off a piece of timber, that is certainly a time-beater.

A reference to our engraving will, when supplemented with a few words, make the idea quite clear. In the plan view is seen the finished push pole held in a wooden frame on two screws, pointed similar to lathe centers. The pole, when in the rough, is octagon in section and placed in the frame as shown, the outline of which, as seen in the side elevation, is that of frustums of two cones joined at the base—that is, the frame is tapered from the center both ways, to correspond with the shape wanted in the completed piece. It is then nothing more nor less than a former for the pole.



MAKING A PUSH POLE.

The other parts consist of an ordinary saw table, under which, on an arbor, is a cutter head improvised out of a matcher head, on which is placed two concave-shaped cutters. On the table above the cutters, and central with them, is another frame (shown in section), which is a guide for the frame holding the pole. In operation, the pole is simply held in one frame and guided over the cutters through the other. Four cuts do the job, and leave the pole in a condition not fully equal to the best lathe work, but smooth enough for switching purposes. Time, five minutes.

Diversity of Car Couplers.

When the Master Car Builders' Association adopted a standard coupler, or rather standard coupling lines, we believed that the result of the movement would be to reduce the number of different forms of couplers in use. There was such a diversity of link and pin couplers that railroad companies labored under great inconvenience in keeping in stock the great variety of forms required for the repairing of foreign cars. Nearly all railroad men supposed that the adoption of a standard coupler by the Master Car Builders' Association would aid in bringing about uniformity, and would end the necessity for carrying so many forms in the repair yards.

The reality sadly mocks the prediction of the coupler reformers. In a report of the Interstate Commerce Commission recently published, mention is made of 105 different kinds of couplers in use, besides others not classified. That is merely the different kinds of couplers that are actually in use on cars. There have probably been twice as many more couplers patented since the Master Car Builders' form was adopted, and the patentees or proprietors of most of them are doing their best to get railroad companies to give their coupler a trail. Verily it looks as if this attempt at bringing about uniformity has ended in making confusion worse confounded.

Automatic Air Brakes and Couplers.

The law relating to safety appliances, passed several years ago by the United States Congress, requires that by January 1, 1898, all cars and locomotives engaged in interstate commerce shall be equipped with automatic air brakes and car couplers. According to the last report of the Interstate Commerce Commission, there were over one million cars and locomotives in the United States which have not yet been equipped with automatic brakes and couplers.

As there is only one year remaining to finish this work, many of the roads will find themselves in a difficult position when the law goes into effect. For the last two years none but first-class roads have been applying those safety devices to their rolling stock, and even some of the first-class roads that are paying dividends have been doing the work very slowly. A majority of roads appear to have done nothing whatever.

There appears to be a belief prevalent that more time will be given to get the brakes and couplers put on, but it is not by any means certain that Congress will agree to this. Something, however, will have to be done, as it is impracticable to make all the equipment necessary before the time expires. According to the existing law, a company violating the enactment will be fined $100 per day for each case violated.

A Uniform Freight Car.

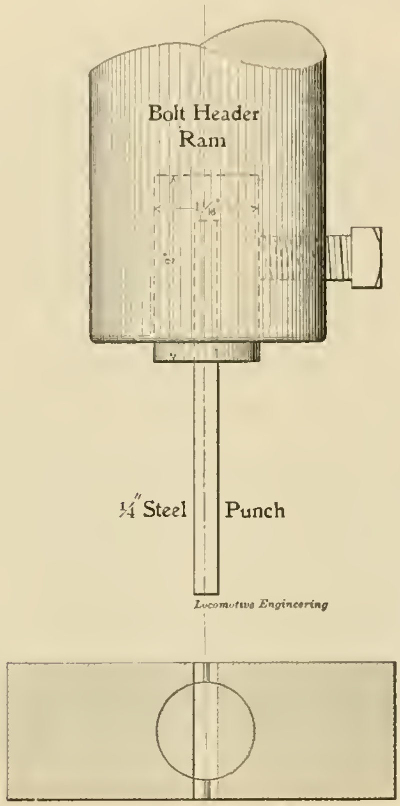
The commendable movement originated by the Ohio Falls Car Company, to induce railroad companies to co-operate in establishing uniformity in the construction of a 60,000 pounds capacity freight car, ought to meet with success, but past experience leads us to fear that the desirable agreement will not be consummated.

It is now twelve years ago, at a time when the writer believed in the sincerity of railroad men to compromise their own small prejudices in favor of establishing standards that would be for the benefit of the railway community generally, that he wrote: "It is now very probable that before the close of the present year, the detailed specifications for a standard freight-car truck will be agreed upon by the Master Car Builders' Association, and submitted to the railway companies for approval and adoption. In view of the numerous defects in the best trucks now in service, some of which, it is not too much to say, are inherent in the nature of the structure, it is not to be expected that the standard to be recommended will be more than approximately perfect. It is one thing to prescribe the dimensions of the various parts, and how they shall be connected, and another thing to make sure that the workmanship shall in all respects be as complete and perfect as the design. Aside from defects in constructive design, or such as are purely mechanical, the controlling consideration of first cost has been a great obstacle to improvement in the past. Master car builders have been afraid to do what they wanted to do, and what would have been true economy in the end, lest the cost of a truck would exceed that of some other truck which the managers considered equally as good. What is now wanted is not only a freight-car truck free from defects which are clearly remediable, and capable of carrying maximum loads, but a truck of such improved construction as to make it for the interest of railroad companies to adopt and use it for all new cars, instead of continuing the diversity of styles and patterns now existing."

It seemed twelve years ago that the day for the adoption of that truck had come, but in this year of grace it seems as far off as ever. Meanwhile the makers of patent trucks are getting in their work, and they promise soon to relieve railroad companies from the necessity of adopting a standard truck that would secure uniformity. It looks as if there would be various forms of steel patented trucks used in the near future to carry freight cars. It would be a good thing for railroad companies if only one form of freight-car steel truck were adopted; but should the forms become as diverse as the forms of car couplers, it will be an improvement on the condition of things existing before the steel truck came into use.

We are afraid that the attempt to get railway companies to adopt a standard form of box car will meet with as little success as the attempts to make them adopt a uniform truck. A uniform size and dimensions of box cars would be a great benefit to railroad companies, and would save a great deal of money in labor, to say nothing of prevention of delays, but there are many petty prejudices to overcome before a general agreement can be arrived at.

As it is easier for a small body of men to arrive at an agreement than what it is to get a multitude of minds to settle in the same direction, we think that the most practicable way to popularize the idea of a uniform box car would be for the different manufacturing car builders to agree together upon what form, dimensions and attachments should be used in a uniform car. If they would agree to build a car of this kind for stock purposes, and were to supply it when no particulars were specified, it would gradually force its way into popularity. Unless this is done, the standard box car will never go beyond the vision of those who perceive the most practicable way of keeping down the first cost of the maintenance of freight cars.



Side Heads

The Bolt-Header as a Punch.

A great many ways have been devised for punching cotter-holes and keyways in bolts and pins at shops not blessed with special tools for the purpose. Some of these schemes we have shown and described, which have given strong evidence of cultivation of the inventive faculty to a degree that always puts gold in the coffers of employers of that kind of talent.

The latest exhibit of the kind coming to our notice is one from the foreman of the car department smith-shop of the L. V. R. R. at Sayre, Pa., who has rigged up the bolt-heading machine on permanent and mechanical lines, to do all this work in his department, and that means a large output per month.

Our engraving shows a plan view of the ram and side-heads only, of the machine, as those parts are all that are involved in the cotter case. The end of the ram is bored out for a sleeve, and that in turn is bored for the punch; a set screw holds the sleeve in place.

The side-heads, after detachment from their vibrating mechanism, are made to do duty as a vise and hold the bolt rigidly before the advancing punch, which is nothing but a piece of round steel of the correct size for the cotter. The ¼-inch punch shown, pierced 8,000 bolts before re-dressing, which operation consists simply in squaring up the end.

Holes for cotters from ¼ inch up to ½ inch, and keyways up to ⅜ x 1¾ inches, are readily made by this shaping of means to ends by a mechanic.

After enduring for many years bitter complaints from their patrons about badly lighted cars, the Manhattan Railway Company of New York have eventually decided to use Pintsch gas on all their cars. The Elevated Railroad Company made a very thorough investigation of all methods of lighting cars before they concluded to adopt the Pintsch system. They talked for a time of using city gas to light the cars, but investigation convinced them that city gas would cost about as much as Pintsch gas, without giving nearly such a good light. Electric lighting companies were invited to send in bids, and some of them did so, but the Pintsch people carried off the prize. It is not so big as people in New York think it is. The Manhattan Railway have 1,200 cars, but only 400 of them are to be provided with Pintsch gas at present. It will take more public howling before the other two-thirds of the car equipment is provided with decent light.

In the United States a worn-out locomotive is known among railroad men as a "scrap heap." That is about the most opprobrious name that can be given to an engine—worse than "a played-out cow." When men on British railways wish to express supreme contempt for a locomotive in bad condition, they call her "a blacksmith shop." A term of half-loving contempt which we heard in the neighborhood of London was: "'Ere's my hold homnibus commin'."

The Passing of the Locomotive—A Reverie.

"Ah, well," said the Iron Horse, heaving a sigh
That was followed anon by a tear;
"They've made me do everything else but fly,
Since Stephenson sent me here.

"From killing an hour for every twelve miles,
To a hundred and twelve an hour;
The Yankee redoubles his toil and smiles
As he doubles my pace and power.

"When tempests have howled I have gone to the front
The force of the blizzard to check;
Of countless collisions I've taken the brunt
And have laid in the ruins a wreck.

"Now, like the 'old woman,' they say I must go,
And so make a place for the 'new';
A mile and a half in a minute's too slow
For the Yankee. I know what I'll do:

"I'll go back to England, for over the sea,
My pace will be swift there, I'm told;
Tho' the old things of England are new to me,
The new things of England are old.

"There a thousand long years are the same as a day,
And a day as a thousand years.
There, when an old thing has wasted away,
Another old thing appears.

"Adieu to the land of the setting sun,
Impetuous Yankee, good-bye.
I'll just jog along to the end of my run,
You put on your wings and fly."
—*Cy Warman in New York Sun.*

The Most Powerful English Passenger Locomotive.

A new eight-wheel passenger engine has recently been designed by Mr. Wilson Worsdell, of the Northeastern Railway of England, which is said to be the most powerful passenger engine in Great Britain. It has cylinders 20 x 26 inches, driving wheels 7 feet 7¼ inches diameter, boiler 52 inches diameter, giving a total heating surface of 1,220 square feet. The tractive force per pound of steam pressure in cylinders is 114 pounds at the rail.

The engine is very light, considering the power developed, and, according to American ideas, is very short of heating surface. The statement has been made that this engine, working in the fast express traffic of the line, does the work on an average of 30 pounds of coal per mile. The co-efficient of adhesion is 2.52, which is exceedingly low and ought to produce a very slippery engine.

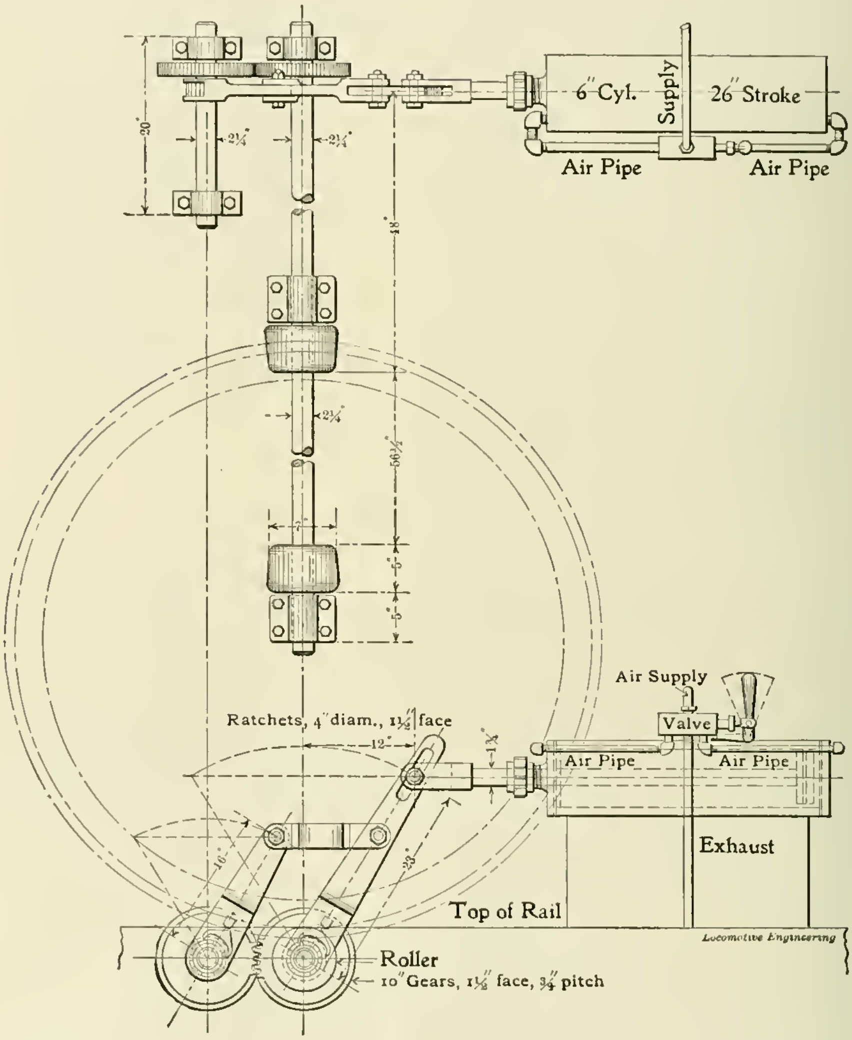
A novel feature of this engine, according to English practice, is that the valves are on the top of the cylinders and are operated by rocking arms actuated by a shifting link motion.

A Valve-Setting Machine.

One of the novelties in valve-setting devices, and something entirely original in that line, has been in operation for some time at the Wilkes-Barre shops of the Lehigh Valley Railroad. It is a product of the fertile mind of Mr. F. Roth, the master mechanic, who had become convinced that there could be no more unsatisfactory method of getting a revolution out of a pair of main drivers than by the pinch-bar plan. The result of his head-work is seen in our engraving of his machine.

Rollers are used under the main wheels, with a shaft resting in boxes let into the floor in the usual way where friction rollers are used, and the shaft is extended out to one side about 4 feet. At the end of this shaft, just inside of the bearing, is mounted a ratchet 4 inches in diameter, having a lever slotted at its upper end to receive a jaw on the end of a piston from a 6 x 26-inch air cylinder. The reciprocating motion from this piston is changed to a rotary one by the ratchet for one direction of stroke of the air piston, and to make that motion nearly constant, another like ratchet was placed on a short shaft and motion transmitted to it from the piston by a short link connecting the levers, and through two 10-inch gears. By this arrangement, when one ratchet pawl is engaged, the other is dragging; the pawls are also made to reverse in either direction at will.

Air is admitted to the piston by a small slide valve similar to that in a triple valve. All movements are controlled by hand, by the small lever operating this valve, it being easier to stop the machine at a given point by this arrangement than would be possible if it had a continuous reciprocating motion. It works so satisfactorily that a 50-inch wheel is made to turn once in 60 seconds, and 20 minutes is sufficient to determine what is necessary to do to the eccentric rods—whether to lengthen or shorten, and how much. Since that is the business end of valve-setting, the device may be pronounced a time-saver.



There is a guard on an English railway popularly known as "The Corkscrew." That name has stuck to him on account of his wonderful ingenuity in twisting his nose into all the secrets of the service.

The Union Switch and Signal Company, Swissvale, Pa., are preparing to put upon the market a new form of track drill recently patented by John P. Coleman.

Practical Letters from Practical Men.

A Novel Air Compressor.

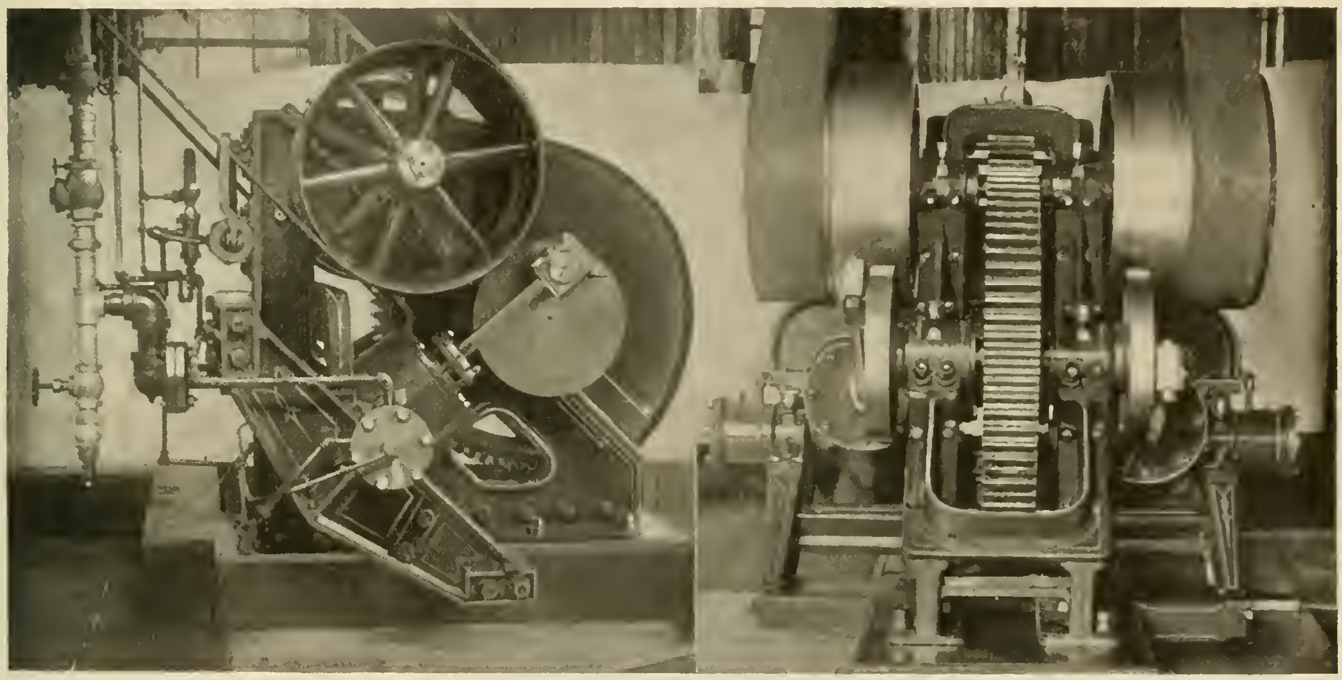
Editors:

We have been making some improvements in compressed-air tools in our shops at Rochester. Believing that a description of our compressor, together with photographs of same, would be worthy of mention in your paper, and possibly of interest to a number of its readers, we submit same to you.

This tool was designed by Mr. C. E. Turner, superintendent of motive power of the Buffalo, Rochester & Pittsburg Railway, and constructed under the supervision of J. A. Barhydt, division master mechanic. It is on the oscillating principle, and has two cylinders 10 inches diameter and 12 inches stroke. The cylinders have a circulation of water around and through the heads and cylinder bodies. The cylinders are held securely to their seats on the frame by air pressure in two small cylinders on the outside of the gudgeon boxes, the pressure on the seats being uniform under all variations of pressure in the delivery pipes.

The cranks are set at right angles and are geared from line shaft to a ratio of 3½ to 1. The compressor is driven by two 8-inch belts, and is automatically controlled by a very neat and simple device, which will allow of only a variation of 4 pounds of air in the pipe line at any time. The undesirable feature of belted air compressors—the slipping of belts—is avoided by a valve which releases the compressor of all air pressure when stopping, and does not close until pressure has been raised to the normal.

This compressor has been in practical operation for the past two months in the Rochester shops, furnishing all the compressed air needed, at 85 pounds pressure without compounding. In operation, this compressor will raise air from atmosphere to 100 pounds, without visible effort. The machine is of ample strength and occupies but little space, showing that much practical observation and thought had been embodied in it by the designer.



A NOVEL AIR COMPRESSOR.

Mr. Turner is a strong advocate of the use of compressed air in shops, and to this end has constructed storage reservoirs, out of old locomotive boilers. These are placed at different convenient points about the shops. In furtherance of this equipment, there are about 3,000 feet of 1¼-inch pipe throughout the yard for testing air brakes on the cars; the pipe system having suitable connections at every point where air is likely to be required. The accessories used in the car tests embrace an engineer's brake valve, a small reservoir and a duplex air gage; these are permanently secured to a small, easily portable, barrow-like vehicle, which is taken to any part of the yards by the inspector when making tests of car brakes. The pipe lines are all connected to the reservoirs, which are supplied by air pressure from the compressor.

J. A. BARHYDT, M. M.

Rochester, N. Y.

Effect of Piston Clearance on Steam Consumption.

Editors:

An editorial writer in the current number of "Locomotive Engineering," in discussing the results of Professor Goss' tests of locomotives, attributes the greater economy at the later cut-off (⅓) to a smaller percentage of condensation and to slightly superheated steam, due to wire-drawing. The reasoning is good so far as it goes, but it acounts for only a small part of the gain due to the later cut-off.

The locomotive engine is necessarily one with large clearance, probably 10 per cent. of the piston displacement, and in many cases even more. Clearance is a very decided factor in determining the best ratio of expansion, and it should always be considered in relation to the point of cut-off, and not piston displacement. With small clearance, the best results are obtained with an earlier cut-off; and with a large clearance, economy calls for a longer steam admission.

For illustration we will take the locomotive, assuming the clearance to be 10 per cent. of the piston displacement: With a cut-off at ¼ the stroke (6 inches), just 40 per cent. of the total steam admitted goes into the dead space, clearance, and from which we get very little in the way of impulse against the piston; with a cut-off at ⅓ stroke (8 inches), only 30 per cent. of the steam admitted is required to fill the clearance space; if we carry the cut-off still later, say to ½ stroke (12 inches), then only 20 per cent. will go into the dead space. It is possible that if Professor Goss had delayed the cut-off still more, and admitted steam at boiler pressure, his results might have made a pound of coal still more valuable.

The question of valve leakage bears on steam economy, and here again the point of cut-off exerts an influence. Leakage is always induced by higher pressure on the confined side, and lower pressure on the opposite side. An early cut-off makes the greatest difference in these two pressures, and a later cut-off tends to equalize; hence, we are safe in assuming that if there is any tendency for steam to leak past the valve, a much smaller percentage will thus escape when the later cut-off is employed. It is probable, however, that the greatest part of the gain from the later cut-off is due wholly to the fact that a smaller percentage of the steam admitted to the cylinder is called upon to fill the clearance space.

If Professor Goss had tested an engine with small clearance, say 2 per cent., his results would have been very different. We have only to study a catalog of builders of engines with small clearance for evidence. Simple "Corliss" engines, and to these may be added the "Buckeye," rarely run with a cut-off later than ¼ stroke, and the majority of them cut off steam earlier. These types of engines are never compounded when run non-condensing. On the other hand, engines with large clearance, when large powers are called for, are usually compounded and are run non-condensing. A decided gain always follows the compounding of engines whose construction calls for more than the average clearance, not because of the greater expansion thus obtained, but because compounding reduces the clearance, or rather reduces the weight of steam which goes to fill the clearance. When the large clearance type of engine is compounded, it is fully the equal of the "Corliss" simple engine in economy. Part of the gain is, of course, due to the reduction of the difference in temperatures in the cylinders.

The gain from compounding locomotives is largely made by reduced clearance. Greater care is taken to keep the clearance down, and then expansion is carried somewhat further, thus reducing the weight of steam which fills the clearance in the low-pressure cylinder.

HARRIS TABOR.
Elizabeth, N. J.

Cotters for Securing Steam Pipes.

Editors:

In view of the difficulty experienced in tightening and slackening steam-pipe joint bolts in front ends, would it not be preferable to employ bolts with keyways punched through and tapered steel cotters? It would be possible to locate the bolts closer to the pipe and they could be applied and removed with greater facility, as owing to the extremely awkward places in which steam-pipe bolts are placed (especially over tee pipes), it is frequently almost impossible to apply sufficient force to slacken and properly tighten screwed bolts. The corrosive action of the gases which so effectually locks nuts upon screw threads would have but little effect upon taper cotters.

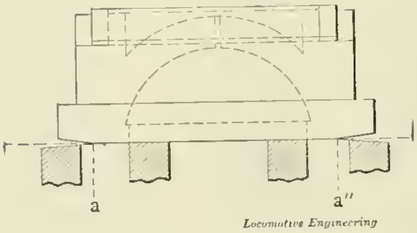
Will those who have seen cotters tried in this capacity please state results?

S. J. HUNGERFORD,
Montreal, Can. C. P. Ry.

Peculiar Wear of Valves.

Editors:

The valves in many of our passenger engines wear in a very strange manner (as shown in inclosed sketch to an exaggerated extent), for which I would like an explanation. From *a* and *a''* outward both the valves and seats wear off (as shown), as though the valves were tilted up a little on each edge alternately; while the bridges and central portion of valves



from *a* to *a''* show practically no wear at all, as the file-marks are plainly visible after engines have run many thousand miles. The valve connections are arranged on several engines in such a manner that the slight vertical movement due to rocker arm is entirely eliminated; yet the results are the same. Allen valves of the same dimensions otherwise apparently wear more rapidly than the plain balanced, and we believe that those having greatest travel, lap and lead also show most wear. As an example of the amount of balanced area for one class (19 inches cylinder), the face measures 11½ x 20½, while balanced area inside strips is 17⅛ x 7⅝, and leakage hole in valve ½. The different classes of engines showing this wear range in valve travel from 5 to 6 inches; outside lap, ⅞ to 1 inch; lead, nil to 3-16. The exhaust cavities are in every case line and line. Steam pressure from 160 to 180 pounds.

S. J. HUNGERFORD,
Montreal, Can. C. P. Ry.

[The only cause we can think of for this wear of valves is that they receive a rocking motion due to the vertical motion of the rocker pin. We think that our correspondent must be mistaken when he says this vertical motion has been eliminated.—Eds.]

Continuous Brakes in Great Britain.

Editors:

Upon page 911 you refer to the use of brakes in England. As to which brake is *the best*, there can be no question. But for certain reasons some of the companies in England choose to use a vacuum brake; but it is a very inferior appliance to the Westinghouse. Looking at the brake question from the sole point of which is the best brake, there can be no question that the whole trains of the world ought to be fitted with the Westinghouse quick-action; it is the best brake.

CLEMENT E. STRETTON, C. E.
Leicester, England, Nov. 12.

Experience With Joy's Valve Gear.

Editors:

I have read your article, page 885, and observe that your experience in America is very much the same as mine in England, namely, that Joy's valve gear is a very unsatisfactory appliance for locomotive engines, and certainly it would be of no use for the speeds and loads that I know American engines have to work.

On the Midland Railway of England there are ten express engines, Nos. 1667 to 1676, having cylinders 19 x 26 and 7 feet drivers, but the engines are failures on account of having Joy's gear.

I am convinced that the best valve gear is the link motion, which was invented and first used by Mr. W. T. James, of New York, in 1832.

CLEMENT E. STRETTON, C. E.
Leicester, England, Nov. 12.

Universal Tools.

Editors:

I send you herewith photographs of some special shop tools. Fig. 1 shows a machine for rolling boiler tubes, cutting out boiler tubes, drilling holes, tapping staybolt holes, screwing in staybolts, and running valve-seat facers and cylinder-boring tools.

We consider this the most complete tool for the purposes named, that we have ever seen, and also think that it should be a part of the equipment of any shop using compressed air. This tool was designed by Mr. C. E. Turner, superintendent of motive power, and Mr. J. A. Barhydt, division master mechanic of the B., R. & P. Ry. It was constructed at the Rochester shops and placed in practical operation at once. The actual saving to the railway company, in flues, together with removing and re-setting same, has made itself so manifest that Mr. Turner has equipped all the shops on his line with the tool.

The machine consists of a main cylinder having a hollow piston through which passes a revolving splined shaft. Air admitted to both sides of this piston balances it perfectly in any part of its travel; therefore, a reduction of pressure on either side of the piston will cause a movement forward or back, at the will of the operator. Power is transmitted from the revolving shaft through a shaft with universal couplings to either the flue expander or cutter, or any other tool used in connection with the device.

The cylinder described is surmounted by a double oscillating engine which drives the cone shaft, and through it, a pair of spur gears which in turn drives the shaft running through the hollow piston in the cylinder controlling the horizontal adjustment.

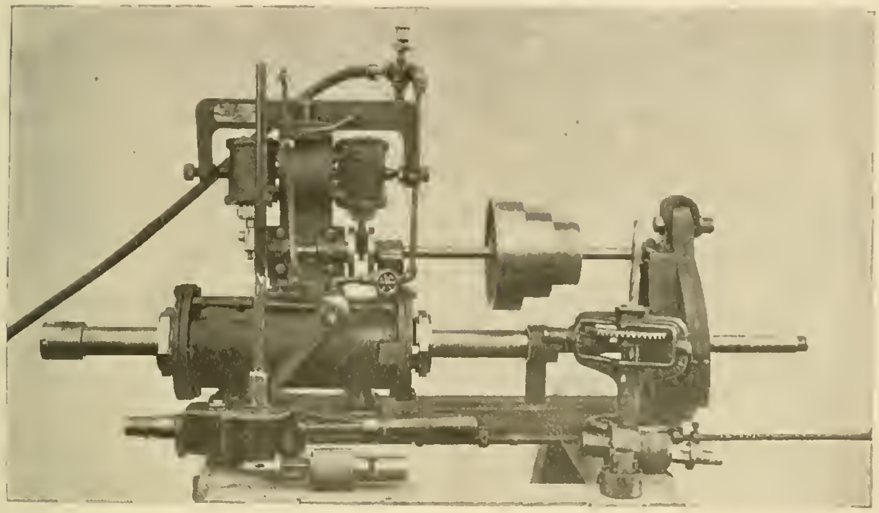


Fig. 1.

Attachment can be made to either the top or bottom shaft, making possible a great range of power and speed for any operation. One very objectionable feature in most air engines, not in evidence in this little motor, is the noise from the exhaust. In this engine it is muffled in such a manner as to be comparatively noiseless, and that without causing back pressure, by passing it down by a partition in the chamber seen between the cylinders.

The tool is well adapted to driving the Stowe flexible shaft, it being only necessary to make direct connection with the shaft, thus doing away with the rope drive and consequent breaking of couplings, dropping of counterweight, etc. In the picture are seen some of the accessories used with this tool; at the right is a drill and the flue cutter used at the back flue sheet, and at the left is seen a staybolt tap and the flue cutter used at the front flue sheet to cut flues to length while in the boiler.

This device has been patented by Mr. Turner, who will be glad to furnish to those interested, any information as to cost and the saving resulting from its use.

Fig. 2 is another useful little air-driven tool of the same general character as Fig. 1, except that it is lighter and more compact. It is in use driving drills, Stowe flexible shafts, cylinder-boring and valve facing machines, and is specially valuable on staybolt and boiler work, either in the back shop or roundhouse, on account of its portability. One man can handle it and secure it to any part of an engine, inside or outside of a firebox. The 3 x 3-inch oscillating cylinders couple direct to the driving shaft, on which is a three-step cone, which is used on both of these machines to drive any one of the machine-shop tools at night, when it is too expensive or not expedient to start up the shop engine.

J. A. Barhydt, M. M.
Rochester, N. Y.

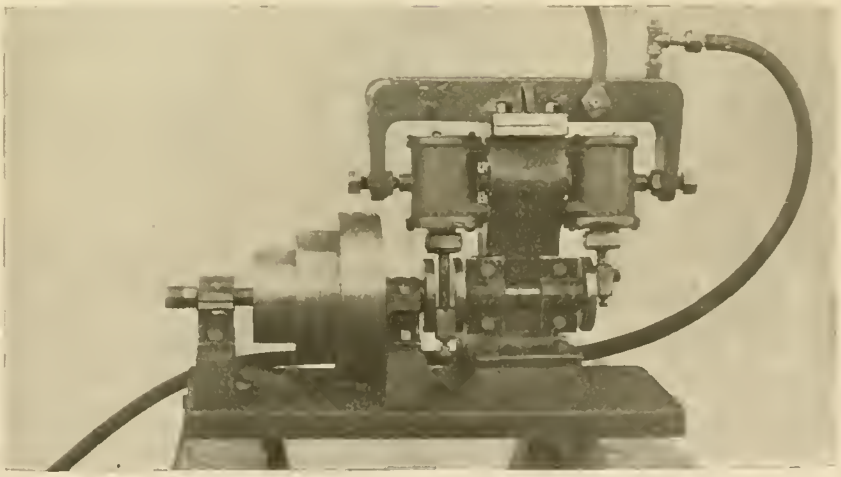


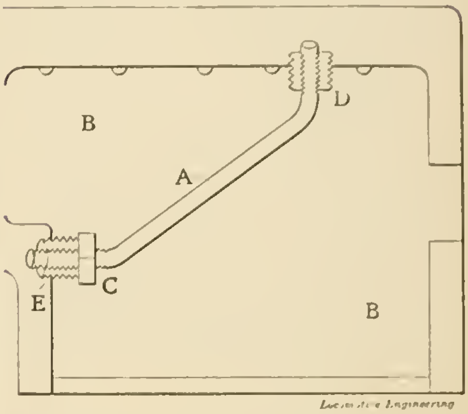
Fig. 2.

Fastening Brick-Arch Tubes.

Editors:

The accompanying sketch represents one of the arch tubes *A* in locomotive firebox, and what we illustrate is the hollow tap *C*, which is threaded inside, so it screws over the end of arch bar. The outside of the hollow tap is made in the same style as any other common taper tap of that size. After the collar nut *D* is screwed up, the hollow tap *C* is to re-tap the hole in throat sheet *E*, and in that way tap the hole in center line with tube. The tap is then taken off, and a collar nut like *D* is put on its place and screwed up with a pipe or alligator wrench. This brings the tube in line, and there will be no trouble of any of them leaking.

The hollow tap is a useful tool. It is



the invention of the boilermaker foreman, Mr. Salomon Keck, of the N. C. R. shops.

J. A. Eisenaker.
Elmira, N. Y.

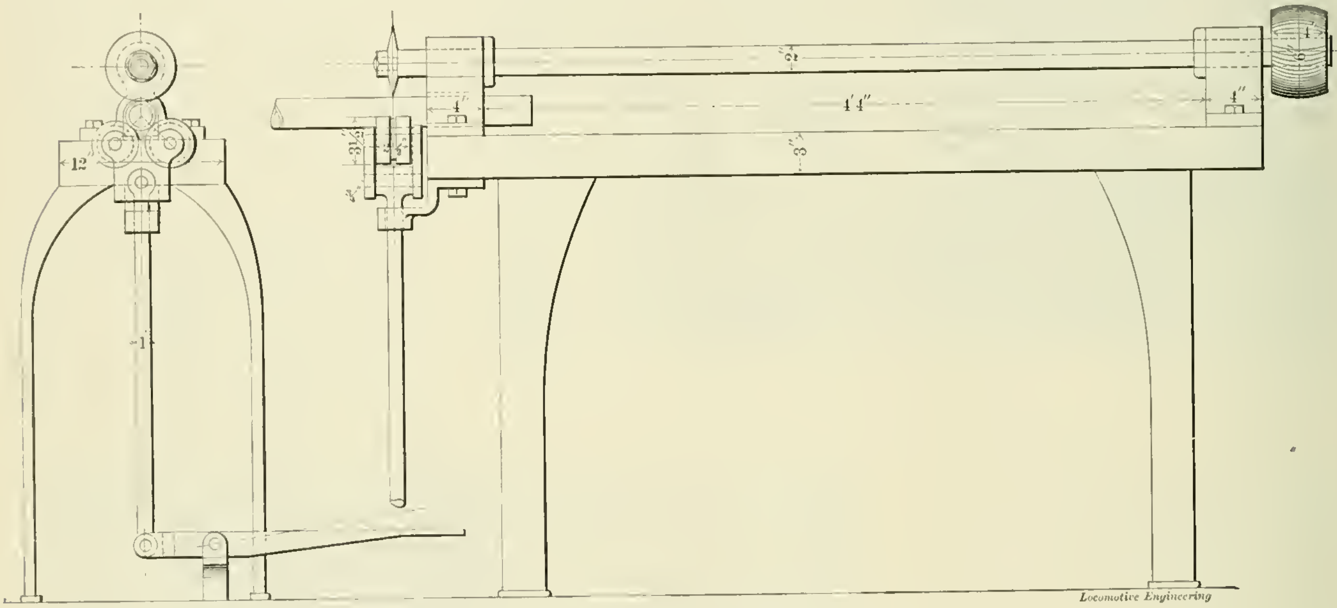
[We have illustrated this tool and published the letter because we are always willing to show up any improved appliances made by railroad men. At the same time we must enter an earnest protest against this manner of fastening the tubes that support the brick arch in a firebox. It is an exceedingly dangerous practice to cut a thread on any tube for this purpose, as the thread in numerous instances has led to breakage, which resulted in scalding the enginemen. The proper way to secure these tubes is by expanding them—the same as the boiler tubes are secured. We do not believe that a railroad company would be able to clear itself in a case for damages caused by an accident happening through a tube breaking that had a thread cut on the end of it. Self-interest, if nothing else, ought to induce railroad companies to adopt the safe method.—Eds.]

Flue-Cutting Machine.

A machine for cutting off flue ends is shown herewith, that is gotten up on different lines than are followed in the generally accepted practice for such a tool. It was designed by Mr. Aldrich, the foreman boiler-maker of the Lehigh Valley Railroad shops at East Buffalo, which are under the supervision of Master Mechanic Jno. Campbell.

The old-time method of carrying the rear end of the cutter shaft on trunnions, and raising and lowering the cutter by means of a screw, was not satisfactory, on account of the lost motion so easily acquired by the parts actuating the cutter.

This machine, it will be seen, is not open to the objections cited, to the same extent as the other, for the reason that the cutter shaft is closely fitted up in boxes that are always in line, and the flue is raised to the cutter, which, under the conditions named, is in the best possible shape to do work. Such is the opinion of the designer of this machine, after a wide experience with both types.



FLUE-CUTTING MACHINE.

The arrangement for raising the flue during the cutting-off process is about as simple as could be desired to do the work. It is made up of two rollers carried by a frame which is connected to a treadle by a rod; the treadle having such a leverage that a slight pressure with the foot suffices to raise the flue against the cutter with enough pressure to quickly make the cut. There are thought to be many advantages in using the foot for this purpose, and leaving the hands free to manipulate the flue.

An improved form of pneumatic tool suitable for calking, beading tubes and similar work has been patented by Chester B. Albree, Allegheny, Pa.

In Schenectady Locomotive Works.

During a recent visit to the Schenectady Locomotive Works, I found that the works were not by any means busy, but they have experienced considerable improvement since the election. I found them working on a group of ten-wheelers for the Michigan Central, and engines of the same type for the Lake Shore & Michigan Southern. They have received an order from the Southern Pacific for five very heavy ten-wheelers, and they have some engines in the erecting shop for the Portland & Rumford Falls.

The drawing office and pattern shop are rushed with work, getting ready for the immense mastodon engines to be built for the Northern Pacific. The cylinders of these engines, which are compound, will be 23 and 34 inches diameter by 30 inches stroke. The proportions for the engines throughout are so much greater than anything hitherto built in the works, that a great many new pattern and designs are necessary. A cylinder, 34 inches diameter, is something new in locomotive building, and it looks like a huge hogshead. They had one of the cylinder patterns in the molding sand, and was nearly ready for pouring. This will be the largest casting ever made for a locomotive.

The boiler for this engine will be 72 inches in diameter at the smokebox end, and will have a great extended wagon top. An idea of the dimensions of this huge boiler can be had from seeing dimensions of some of the plates. The plate for the first ring is 224¾ x 71¼ inches, $\frac{11}{16}$ inch thick; for the third ring it is 241¼ x 64 inches, $\frac{13}{16}$ inch thick ; the bottom sheet is 105½ x 25½ inches and ½ inch thick; the tube sheet is 75½ inches diameter and $\frac{9}{16}$ inch thick ; the top sheet is 125¾ x 115 inches and $\frac{9}{16}$ inch thick ; the two side sheets are 123¾ x 73¾ inches and $\frac{9}{16}$ inch thick. They could not get a single sheet large enough for the outside of the firebox, so they had to put in seamed ones. The welts are 10¼ x 63½, $\frac{9}{16}$ inch thick, and 16½ x 58½, $\frac{9}{16}$ inch thick.

I noticed that several new practices have been introduced into the shops since I last visited them. In the boiler shop there is a special form of Hilles & Jones drilling machines, which is used to drill out all the holes for longitudinal seams. They punch a small hole first and then finish it with a twist drill. When the seams that have punched holes are bolted together, a reamer, driven by an electric motor, is used to ream the holes true. This effects a radical improvement in boiler-making, as the men never need to use the drift before putting in the rivet. They are very careful now about reaming all bolt holes to gage sizes. As the bolts are all turned to gages, no fitting is necessary.

They have lately put in a new Bement & Miles miller, very powerful and stiff, for milling mud rings. Most of the mud rings are planed top and bottom and then milled in the sides. This practice entails a good deal of work, but it insures a very good job. In connection with this operation, I noticed they have changed the radius of the inside corners from 1¼ to 2¼ inches. They say that the sheet can be fitted much better with the greater radius than with the smaller one.

They are doing a great deal of forming work with their large hydraulic press, and every week brings new uses to which this useful apparatus can be applied. They are making dome caps and all sorts of casings under the hydraulic press, besides the forming of boiler heads, gussets, sheets, etc. The work turned out in this department is very handsome and artistic in appearance.

They had a curious experience in the forming of a base for smokestacks, which is now made out of pressed steel. When they first tried to make it, they began by punching an oblong hole as near the contour of the base as they could make it. Every time the metal was put under the press, the base came out cracked. One of the workmen had been reading a book about making forms under the hydraulic press, which said that holes ought all to be punched round. This was tried and they had no more broken stack bases.

They use small electric motors for nearly every purpose where work has to be done that cannot be put under a heavy tool. The electric motor, with them, has dispensed almost entirely with hand drilling and reaming.

The air hoists are used in a very systematic fashion, although the shops are particularly well supplied with traveling cranes. Above every tool where work is done that one man cannot lift easily, there is an air lift, most of them being made from brass tubing.

While lounging around the machine shop, I got watching a man boring the brasses of solid-ended rods, and I was struck with the extraordinary care he exercised in measuring for the center. When talking to Mr. White, the assistant superintendent, about the great care with which the work was done, he said that they required absolute accuracy in the boring of these holes. To show how close the work was done, he took two sets of side rods for a ten-wheeler, with the front and back pins 15 feet centers; then the workman took plugs 1-64 inch larger than the crank pins, and put one into each of the holes, and they went down through the brasses of both sets of rods. The fit was just sufficient to make the plug, by its own weight, slide down through the two bearings. This is a very good illustration of the extraordinary accuracy attained in fitting up the essential parts of a locomotive. We are not surprised to find parts of a sewing machine or typewriter made to the thousandth of an inch, but it is marvelous to find the same accuracy with the large forms used in locomotive use.

They are doing a great deal of work in the testing department, and it is done very systematically. They keep records of tests of all sheets used in boilers, and of the material of every part likely to break. This has already borne very good fruit, in preventing manufacturers from sending material that has not been properly inspected and tested.

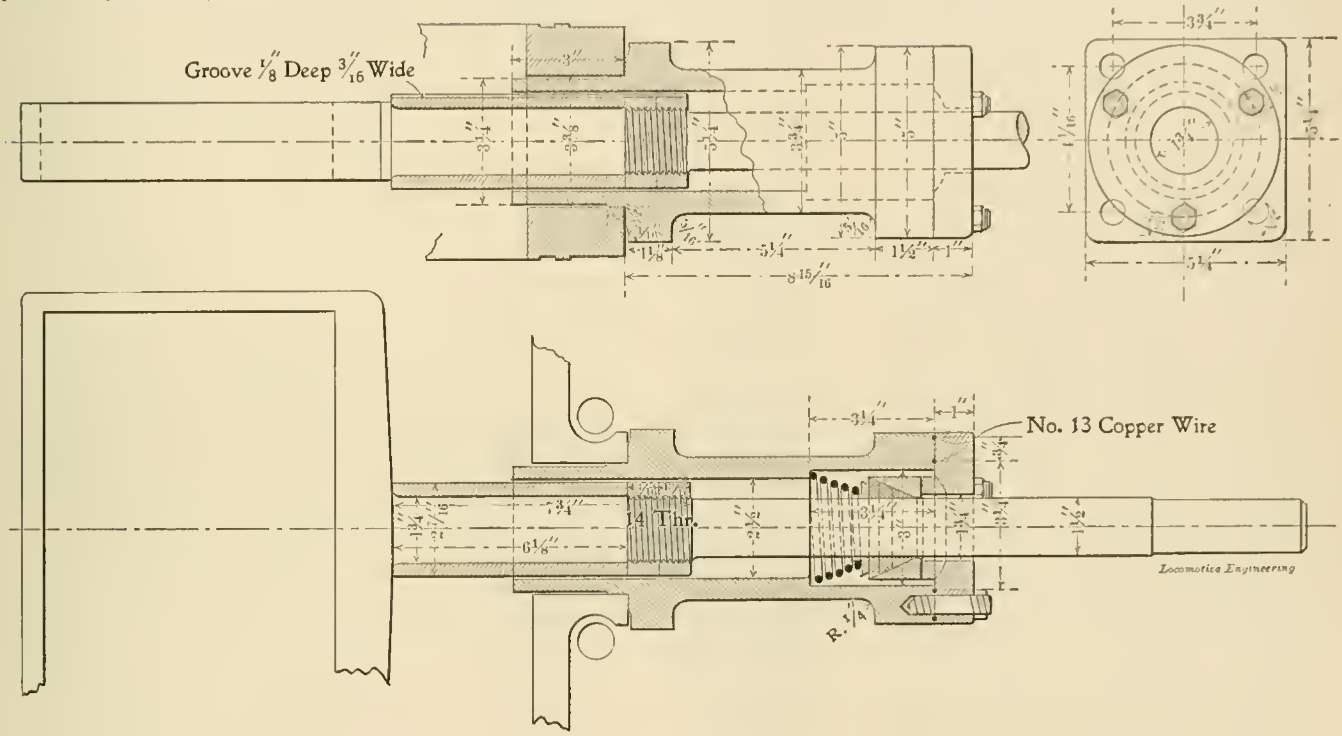
I notice they are cutting off the ends of flues with a revolving cutter having one side beveled and the other perfectly flat. Mr. White tried a cutter of this kind years ago, but it did not occur to him to make one side flat, and it always left a burr which had to be ground or filed off. It struck some long-headed man to make the little change, and now the flues are cut off perfectly smooth. I do not know whether or not that cutter has been patented, but if it has, those who have tried revolving cutters previously would be inclined to claim the invention. This has been the experience with a great many celebrated inventions. One man or set of men produce an appliance which is nearly perfect, but not quite; another man comes along and makes what seems a very trifling change, but it is just the difference that makes the failure into a success. This was the history of the development of the pop safety valve, of the balanced slide valve, and of a great many other things that might be mentioned.

They have lately got out a new cylinder pattern, with the admission and exhaust passages so separated that lagging can be placed between them. This may effect a saving of steam by preventing condensation; at least that is the theory. It seems to me to be rather far-fetched. Be that as it may, there is demand for that style of cylinder, and the locomotive builders have to meet it. It greatly increases the danger of failure in casting cylinders.

A. S.

Valve-Stem Guide.

The device shown in our engraving, was designed on the Old Colony Railroad for the purpose of relieving valve-stem packing of the weight of the parts usually supported by the same, and thus insure longer life to the packing by saving undue wear. To reach that end, the valve stem was increased ¼ inch in diameter for a distance of 7¾ inches from the yoke, and a sleeve, made to a sliding fit on the enlarged portion, was held in position by two nuts against the outer end.



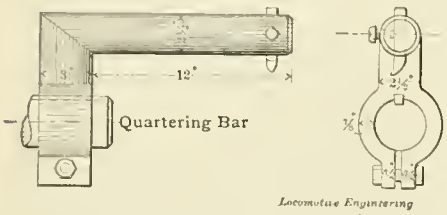
VALVE-STEM GUIDE.

The sleeve was also made an easy fit in a casting made to receive it and the packing. This arrangement formed a perfect guide for the valve stem, and left the packing to exercise its functions as packing, and not take any wear other than that due to the reciprocating motion of the valve stem. The sleeve and guide as shown has a record of ten years' wear without renewal.

The consolidation locomotives on the New York, New Haven & Hartford haul trains weighing 1,800 tons at a speed of 25 miles an hour. The engines are reported to be doing their work very satisfactorily.

Tool for Truing Crank Pins.

Master Mechanic John Campbell is using the primitive but very efficient tool shown in our cut, for truing up worn crank pins, at his East Buffalo shops. This device has not received the attention it is properly entitled to, the tendency being to strain after something more expensive and complicated, that will not



give any better results. This tool is secured to the quartering bar on the wheel lathe by means of a split clamp and key, and will do as good a job as any other device. Its simplicity puts it within the reach of all.

Origin of the Word "Tram."

In a recent issue of "London Engineering," a correspondent makes the statement that the word "tram" originates from the word "Outram," an owner of that name having been a pioneer in the construction of early railroads.

This is one of the far-fetched theories respecting names, that has no foundation except in the ingenious imagination of certain writers. The word "traam," meaning the handle of a wheelbarrow or sled, is Scandinavian, and has been known ever since the articles to which the name is applied were used. It has also been used in Scotland for centuries as applied to the shafts of carts, wheelbarrows, ploughs, etc. Burns, in his "Inventory," says:

> "An auld wheelbarrow, mair for token;
> Ae leg an' baith the trams are broken."

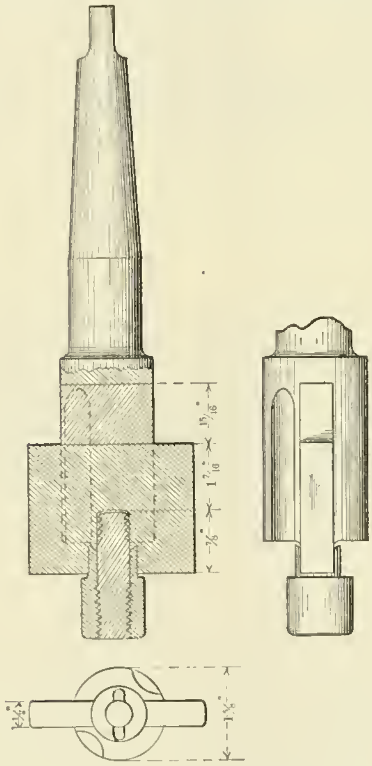
In 1555 the following note was written in connection with an English institution: "To the amendinge of the highwaye or tram from the weste ende to Bridgegait, in Barnard Castle, 20s."

From this testimony it would appear that the word "tram" has probably been used since implements with parallel handles were employed, and it has no doubt originated from the word "trammel." The French use the word "tramme" in the sense that we use "tram," and it is to be found in old books written in that language. Instead of the name "Outram" giving us the expression "tram," it probably originated from the word as many other surnames have come from the occupation people followed. In old times in Scotland, when two men were required to manage a plough, one man was within the trams, the other was out-tram man. Nothing is more natural than that some man doing that work should get the name "Outram" until it became his recognized surname.

Variable Counterbore.

A method for reducing counterbores to their lowest terms is in vogue in the Sayre shops of the Lehigh Valley Railroad. It is accomplished by making one drill shank do duty for any size of counterbores. The shank is slotted at its lower end for the cutters, which are of a common thickness, after which it is tapped for a stud to receive the guiding tits, which are made of sizes to suit all demands, and this constitutes the variable feature of the tool.

These tits are made hollow and tapped out to screw on the stud in the shank, and are fitted with a shoulder to bear on the bottom edge of the cutter, which is faced true to receive it. The stud construction can be replaced by a solid piece turned on the end of the shank, and threaded for the tits; but as careless handling is certain to break it off and make a stud necesary, the form as shown was adopted, making one of the best constructed and handiest tools of the kind.



Wood-Working Shop Notes.

The practice of piping all wood-working tools to the shaving exhauster does not find favor in the eyes of Master Mechanic Griffith, of the Delaware, Lackawanna & Western Railroad at East Buffalo. The ground is taken that he can use his shop power to better advantage on his tools than on the exhaust system. The piping is only used to take the refuse from the sill dresser, gainer and matcher, and the fan is never run except when these tools are in operation.

One pipe is placed in a central position with reference to the remainder of the tools, and run down to the floor. The shavings from these tools are conveyed to the pipe by the men who handle the tools; each man is thus held responsible for the appearance of the space controlled by him and his machine.

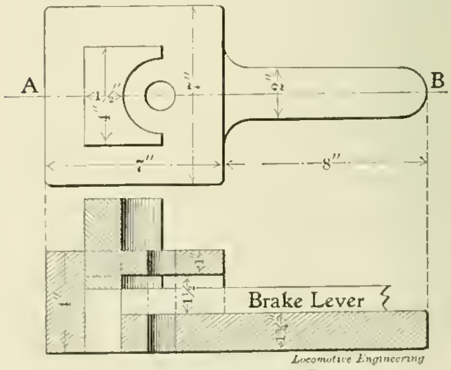
A strict insistence on cleanliness is one of the rules that are never relaxed by the management of these shops; the neat appearance of the men and surroundings bear witness to the statement that there are no shops in this country that excel these in this particular—and this applies to the whole plant, car shops and machine shops alike.

In the car-erecting shop, no horses or trestles are used; a car body is elevated with air jacks sufficiently high to reach rods hanging from the roof truss, by which it is suspended until the trucks are again run under the car. This system is a good one to give access to the bottom of a car, but it is open to criticism, aside from the fact that few roof trusses are constructed with a margin of strength more than sufficient to hold themselves in the air.

Die for Trimming Brake-Lever Ends.

A very neat device for trimming the ends of brake levers into a semblance of symmetry is used at the smith shop of the Buffalo, Rochester & Pittsburg Railway, at Rochester, N. Y. It is given herewith as designed by the foreman blacksmith and used on the steam hammer.

The plan view shows a block with a die which is rectangular on three sides and concaved on the fourth, the concave part being the cutting face that trims the ends of the lever. The section shows the block and die and also a portion of the brake lever. In the operation of trimming, the lever is placed in the opening of the block and a pin passed through the block and lever, holding the latter firmly, and the die is then driven down past the project-



SECTION A-B

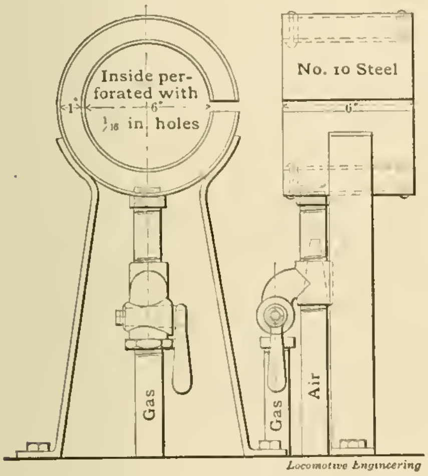
ing end of the lever, taking off the stock neatly and accurately at a constant radius for each end. A trimmed lever has the appearance of having been slotted, so smoothly is the work done.

A Brazing Furnace.

One of the best devices in the way of a furnace for brazing purposes, that we have seen, is shown herewith. It was found in operation at the Buffalo, Rochester & Pittsburg shops at Rochester, N. Y., where it is said to surpass the best results obtained with coke or charcoal.

The little affair was made of two No. 10 steel plates, bent around two wrought-iron rings and riveted to same, the rings serving the purpose of two heads, leaving a cylindrical space between the inner and outer plates, the former of which was perforated over its entire surface with holes $\frac{1}{32}$ inch in diameter, about ½-inch centers.

A substantial support held the arrangement at a convenient working height above the bench. An air pipe was tapped into the under side of the cylinder, and just below the latter, this pipe was joined by a connection with the (illuminating) gas main. At this junction of the two pipes was a valve for controlling the admission of gas, and in the air pipe near this point was a nozzle to carry the air beyond the entrance of the gas.



Regulating the admission of air and gas in proper quantities, a heat is developed that will cause spelter to get a move on itself as quickly as by any means we know of, and with the advantage that it is equalized—no one place hotter than another.

For brazing of pipe work, and all kinds of sheet joints, this furnace is thought to have no superior.

A paper read at the meeting of the Society of Mechanical Engineers, last month, on "Efficiency of the Boiler Grate," gave particulars of a great many boiler tests. According to the author, the tests went to show that a consumption of 13 pounds of anthracite per foot of grate per hour was the most economical rate, and that with bituminous coal 23.8 pounds per hour in the same area gave the most economical results.

Some Smith-Shop Dies.

We illustrate a couple of dies taken at random from a large collection of special forming tools, for the purpose of laying emphasis on our contention that dies are the thing for rapid production of work in the blacksmith shop. The samples shown are not possessed of any particular virtues over the lot of which they are a part, but are simply well-made dies, designed by the foreman of the motive power blacksmith shop at Sayre, Pa.

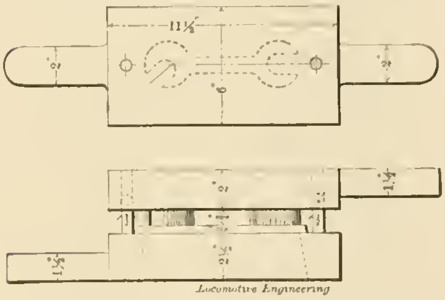


Fig. 1.

It will be noted that care is taken to specify the department in which the shop is located, for the reason that the Lehigh Valley Railroad has two smith shops at the point named above, and both are presided over by men who are up in their business.

Fig. 1 is a die for making packing wrenches on the steam hammer, for which purpose scrap spring steel is used. These dies are made solid, and when the cutting edges show signs of fatigue, they are planed on the face and the edges are brought up to cutting shape again. The upper die has the contour of the part to be made, and is guided into true alignment with the opening in the lower die, by means of guide pins in the latter which work in corresponding holes in the upper die.

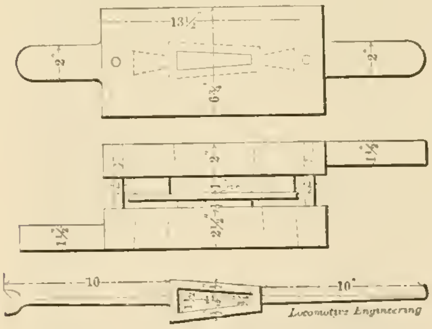


Fig. 2.

The dies in Fig. 2 are also used on the steam hammer to work up old spring steel into a combination packing hook and wrench. The wrench part is at the center of the blank shown in outline on the plan view, the opening of which will take any nut from ½ inch to ⅞ inch. After the blank is cut out, the ends are drawn out as shown in the finished article below the dies. These hooks are very popular on the road; it is said that no dope bucket or engine kit is complete without it.

Jim Skeevers' Object Lessons.

The New Performance Sheet--Where Light Trains Were Not Wanted--More Ways than One to Handle Men.

BY JOHN ALEXANDER.

The last time I wrote you, Skeevers and the boys were wrestling with the fuel and oil economy problem.

Skeevers got up his dollar performance sheet and left out all reference to pints, pounds and tons. At the top of the sheet he had a plain statement of the kind of fuel used and the price per ton, the kinds of oil used and its cost per gallon. Opposite the numbers of the engines came the name of the engineer, as usual; then the fireman's name; following was the monthly cost for fuel, oil, supplies, repairs, etc.; then the cost per mile for oil and fuel, and finally the cost per ton hauled *per mile* for both.

Skeevers allows a certain amount of fuel and a certain amount of oil per mile for each class of engine for running the engine, and then bears down hard on the cost of fuel and oil for hauling tons of freight miles—that's what counts.

The first two months Skeevers did not allow for running the engines at all, and some curious things happened.

In the first place the men soon discovered that the fellow with the lightest trains made the worst records, and the peculiar anomaly of an engineer kicking because he had light trains was presented when Hank Bitters came into Skeevers' office and "made a holler," as he called it, because his local train was always light one way, and he explained his poor record to Skeevers thus:

"Mr. Skeevers, it's like this: If I run my consolidation over the division light, it takes considerable coal and oil; if I pull six cars, the amount used by the engine is divided up between the six loads, and if I pull twenty, it's divided up into twenty parts. The fellow with the full train has the advantage every time. Now, I'm on local one way, and usually have a very light train most of the time. You ought to allow so much coal and oil a mile for engines, anyhow, and just count what a fellow uses in doing work that the company gets paid for. What d'ye think?"

Skeevers thought Bitters was right, and said so.

One day, as Skeevers was going through the roundhouse, the boiler washer was blowing off an engine, and the house was full of fog and noise. From the depths of this gloom Skeevers heard the sonorous voice of Rory Moore, the traveling engineer, jacking up a runner for a poor oil record. Skeevers listened:

"Now, Tom, this is the last time I'm a goin' to tell you," said Rory. "You've had notis enough. Git right down to business, and use as little oil as any of 'em, or I'll pull you off the run. See! The 'old man' (meaning Skeevers) is a goin' to have results or jobs. I don't care if you have a new engine; the road's goin' to have less oil used. Cut! Well, let her cut; don't you use the oil, or I'll pull you off. Remember that. Why, when I used to run the '16' I could"——

Skeevers didn't wait to hear that; he knew it was twenty years since Rory had run anything, and that he couldn't get over the road with any kind of a modern engine in anything like modern time or with modern economy.

Skeevers waited until afternoon, and then sauntered around to that same engine and called Tom down. Tom was ugly mad at what Rory had said—came down with a bad grace.

"Tom," said Skeevers, pleasantly, "would you mind going down on the Coal Creek branch for a week or two, as a special favor to me?"

"Well, I don't know, Mr. Skeevers; but I—say, does old Rory ever go over the branch?"

"I'm afraid not much——"

"It's all right; I'll go. I don't care much about bein' away from home and leavin' the '310' here. Can I have her when I come back?"

"Yes, Tom; you can take her with you, if you'd rather. I'll tell you. I've got a lot of young fellows down there that are careless, and I can't interest 'em in this oil or coal saving—they see so much coal they think it costs nothing. I want to send a good, careful man down there to set 'em a pattern—going to commence a special bulletin for that branch next month. Now, I know you can do it, and do it right and honest—use all that's necessary and not waste any. You know there is nothing like a pattern to build to. Much obliged, Tom; I knew you'd help me out. I'll send you down soon as I am ready. How's she doin'?"

"Pretty fair; got her to steaming now; but she runs a little warm yet, and—well, I have to use a little more oil than regular; but I'll do the best I can."

"I know you will, Tom. Go out to the storehouse and tell Harry I said to give you a package of that flake graphite to put in her boxes; she'll be all right. So long!"

Tom scratched his head for three minutes, and then went and looked on the performance sheet for his name; it was down near the tail; then he scratched again and went home. That night he told Tom, Jr., who is a fireman, that Skinney Skeevers was the decentest man that ever had charge of anything, and a man that wouldn't try and help him out ought to have his gullet cut.

And say, Tom did go down on the Coal Creek branch, and he did set the boys a pattern that will make 'em hump to equal. It's funny, but the men there said he could run light on oil because he had a new engine—same reason Tom first claimed for using more!

There are more ways than one to handle men.

Skeevers thought long and hard over what he should do with Rory Moore, the traveling engineer. Rory had a leg broken through his own carelessness, years before; but that was in the days when everybody was against the railroad, and rather than let him sue for damages, they created a soft place for him and agreed to give him a life tenure for it. Skeevers figured it out that the company would have been "in" big money if they had let him sue. He antagonized the men and loved to show his authority rather than teach; he always said "Go," never "Come;" unlike Skeevers, he was no leader.

Skeevers had just concluded to ask the general manager to "promote" him to some job in the water department, when Providence came to his aid and sent Massey over on a visit.

There had been talk of a strike on the Midland and Massey was scared; he always had a blue funk when he heard that the engineers and firemen were uneasy. He had spies out, but they seemed to report little to comfort him, and Massey was suspicious of 'em, anyhow.

"Now," said he, "if I only had Rory over there, he'd find out for me and he'd jolly 'em up. Great man to go among men and get 'em satisfied. That traveling engineer I had was no earthly good; always messing around about coal and oil economy and a regular crank on air brakes; had to set him back runnin'. Now, Rory——"

"Glad you spoke of it, Mr. Massey," said Skeevers; "was just wondering what what I'd do with him. Got orders to cut expenses again; thinking of putting him on the pay car. If you can give him a better job on the Midland it will help all three of us out—he's out in the roundhouse now. Jimmy, Jimmy! go out in the roundhouse and find Moore; tell him Mr. Massey wants to see him in my office right away. Yes; Rory would find out all that's goin' on for you. They couldn't do much in a division that Rory wouldn't put you onto," said Skeevers, lowering his voice and winking at Massey.

Skeevers talked gravely of the troubles from organized labor, and the value of a peacemaker general, until Rory came; then he left the two worthies alone for half-an-hour.

"Mr. Skeevers," said Rory, coming into his private den; "Mr. Massey wants me to go to the Midland. I don't like to leave you, but he offers more money—but I've got a life job here, and——"

"Let me congratulate you, Rory; it's a great chance for promotion. Don't you see that Massey, poor fellow, is sickly—on his last legs? You go, and go right away; be his right-hand man and you will soon be—well, you know."

Then Rory thanked Skeevers, shook his hand warmly, and went out and clinched matters with Massey.

Verily, there are more ways than one to handle men.

The news of Rory's resignation leaked out quickly, and inside of twenty-four hours it had got down to the general office. As soon as the general manager heard it, he wrote a personal note to Skeevers as follows:

"My Dear Skeevers—Just learned with pleasure that you had buried another dead man on the Midland. That's right; let them have all of them. Rory has been a thorn in my flesh for years, with his confounded life contract. In reference to the position, I would consider it a favor if you promote Engineer E. J. Staver to the position. We want young blood; I think he is capable, if he is a nephew of mine. I used to have compunctions about this relation business, but they have worn off—everybody favors relations; it's natural. "A. W."

Not content with that, he dropped a line to his nephew and asked him to call upon Skeevers in reference to a new position.

That very evening, as Skeevers was enjoying his after-supper cigar, Staver rang the door-bell and was ushered into the Skeevers sitting-room. Skeevers welcomed him warmly, gave him a cheroot and talked about the weather. Mrs. Skeevers took the baby into the next room, leaving the men to themselves.

"Well, Ed, what's new?" asked Skeevers.

"That's just what I come over to find out," answered Staver. "I got a note from 'A. W.' when I got home to-night, to call on you about another position, and, being as I live in the same block, thought I'd come over and find out what was up."

"I got a note, too," said Skeevers, slowly, blowing a cloud of smoke toward the ceiling. "I suppose you have heard that Rory Moore has quit?"

"No! I thought he had a cinch."

"Well, he did have; but he traded it to Massey," and Skeevers laughed.

"Well, Mr. Skeevers, was you considering me?"——

"Yes, Ed; I was just thinking about you and that job when you came in; and do you know what I thought?"

"No; but I'd like to know."

"Well, I was thinking that it would be a bad thing for you, for me and the service—but especially for you."

Staver kept still and looked solemn for a minute, and Skeevers continued:

"There are a good many reasons why you would be a dead failure in that position, and to fail in such a job at your age is a set-back for life. Now, you can't afford to fail, can you?"

"No, I don't want to, but I'm not so sure I would. I think I'd like it, and no one would try harder, Mr. Skeevers."

"I know that, Ed; that's the worst of it. You'd fail for other reasons than the ones you were to blame for. Let me explain it to you.

"You are not a favorite with the men. Now, a traveling engineer don't need to be a favorite, but he must be a man that they like and respect as an engineer—one they can look up to as being as capable as any of them.

"You came on this road about ten years ago to fire; was put to work ahead of a lot of men on the list. Why? Because you were a nephew of the general manager.

"You were promoted two years earlier than other firemen. Because you were a better fireman? No; because you were a nephew of the general manager.

"You pulled freight eighteen months and was given a light passenger run ahead of a dozen older and as capable men. Because you were a better engineer? No; because you were a nephew of the general manager.

"You are looked upon as a man among men, who is not to be judged upon his merits, but his blood—a man with a pull.

"Now, I believe you are a good engineer; above the average, perhaps. But you cannot be judged on your merits here. I believe you want to do the fair thing and go to the front because you deserve to, don't you?"

"Yes, I do; and Mr. Skeevers, I've often thought I'd quit and go on another road, just for the way the boys hold me under suspicion like. I've never tried to join their lodges, for I know they think I'd carry things to 'A. W.' But"——

"Well now, Ed, look here. You are a young man yet, and there's lots of room for you on your own merits; let me help you out. I don't blame you; you were pushed ahead, and, like most of us, took what the gods sent and was happy—most human beings would. You take my medicine and I'll warrant a cure of all these ills, or no pay. What do you say? The medicine is unpleasant to the taste, but good for the system. What do you say?"

"I'll do just what the doctor says," said Staver; "and really, Mr. Skeevers, I'd rathered be figured on as E. J. Staver by all hands than as Mr. Wider's nephew—I ain't to blame for being a relative of his, am I? A man has to have some relations."

"I've always noticed that they do," answered Skeevers, lighting a fresh cigar. "But listen—the doctor is prescribing now.

"In the first place, I want you to write 'A. W.' a nice note, telling him you don't want the job—that all hands would say that it was on account of your blood, and not your ability; that while you are proud of the Wider blood in your veins, you want to show the men and the officials of the G. A. L. that you are an engineer first and a nephew afterward, and you think you can do that best on a freight engine, and have asked me to transfer you to one. Have you got that?"

"Yes; go on."

"Then write me a note, asking to be transferred to a freight engine on the division farthest from headquarters, and simply add that you realize that older men and better men deserve the easy runs, and that you want to work where the men don't know who your relations are. Stop there and don't tell a soul that you have written either note."

"Yes; anything else?"

"You are a single man and don't care where you are. I'll send you to Granger to trade off with a man who wants to move here on account of his children going to school. You go into the freight pool there and saw wood. You have something in you; get it out. You stand at the head of that performance sheet month after month, and show all hands that it's Ed Staver and not A. Wider that is backing you, and then I will have a good reason for promoting you—and I will promote you. Your reputation with the men leave to me. I'll square you there, and I won't be all winter about it. I've got the 'leakiest' time-keeper on earth in Ball; he's a chronic gossip. I left the 'old man's' letter, equal to a command, about your taking Rory's place, where Ball would see it—he has peddled that out long before this, and the Stove Committee are discussing it now. Just you keep still and leave that to me. Can you go to Granger Saturday?"

"Yes," said Staver, getting ready to go. "I'll be glad to, and, Mr. Skeevers, I want to thank you for this talk—I'm going to surprise you; watch me. Good-night!"

"James," said Sarah, ten minutes later, "I was just thinking that there are more ways than one to handle men—that's one way."

The next morning Skeevers ordered the roundhouse foreman to put Ole Sanderson on "7" and "8" regular, and send E. J. Staver to his office; then he took a long walk through the shop.

While he was out, the "old man" came in, nodded to the clerks, got into Skeevers' chair in his little glass pen—out of sight of the door—hunted through the drawers for a cigar, found it, put his feet on the desk and waited.

Skeevers came in and stopped in the outer office to wash his hands; before he was through, the door opened and a half-dozen engineers filed in under the leadership of Milt Smith.

"Good morning, Mr. Skeevers, said Milt. "Don't git scairt; this ain't no Grievance Committee. We jest come in to ask you one question; then we're all a goin' to kneel right down by that railin' and pray that you answers it the way we want yer to. There ain't no manner o' dou't in any of our minds that you had a reason for chain-gangin' the passenger engines; but now that the '511' is out, we hope and pray that you give us our regular engines agin."

"Well, boys, I'll relieve your minds right now—you will all have your regular engines again to-morrow, the 1st. I did have an object in the change; that object has been accomplished, and we will go back to the old way—it's the best."

"Boys," said Milt, solemnly, looking around to them, "shall we kiss him?" Then, recovering himself suddenly, he said: "Really, Skin —— I mean Mr. Skeevers, we are very much obliged, and while on the thanks branch we want to say that we thank you for putting Sanderson on the run that belongs to him by rights; he ought to had it when young Staver got it; but that was a'fore your time. O'course, you can't help pushin' the young lad along—we know how that is—old Rory wan't no good, and the kid would have to be mighty poor if he couldn't do better than him, and lessen he gits to feelin' his oats and gits——"

"What are you driving at?" asked Skeevers.

"Why, our new traveling engineer, Mr. Staver, of course; you know he's got a cinch; but Lord, man, we don't blame you——"

"Now, boys, look here; this is too bad. Just let me tell you something. You don't and never did give young Staver credit for what he is; as engineers go, for a young one"—here Skeevers bowed to the veterans—"he is above the average; but if he was the best and was promoted, you fellows would not give him credit. Now, I don't know as a man is justified in showing private letters, but here's one from Staver that shows that he's a man among men; for mind you, he could have had Rory's place if he had wanted it, but he refused it——"

"Refused it!" said three men at once.

"Just read that out loud," said Skeevers, producing Staver's letter from an inner pocket and handing it to Smith.

Smith read:

"Jas. Skeevers, S. M. P.:

Dear Sir—I hereby make application for transfer from passenger to freight service at your earliest convenience. In making this request, it is due you to explain that I recognize now more than I did at the time that older and better engineers are entitled to easy passenger runs. I request that you send me to the farthest end of the road, where I can be known and measured by my work and not by my blood relations.

"Respectfully yours,

"E. J. STAVER.

"Private."

"Milt Smith, all of you," said Skeevers, "you have misjudged a man. There's a boy who wants to stand on his merits with the rest of you and don't want any advantage, yet you fellows won't let him. It's you, not he, that mention his relationship with our general manager."

"That's right, Skeevers," said Milt; "and here's a sucker that ain't afraid to say so to him. I'm agoin' right out to the roundhouse and shake hands with the young feller; he's the making of a man."

"No use now, Milt; he's in Granger; went down on No. 1—going to run out of there. But mind you, he deserves your respect; he's the peer of any of you; don't forget that when you do see him."

"Well," mused Squire Tobin, "if Mister Staver ain't going to be traveling engineer, who is?"

"That's to the point," said Skeevers, smiling, "and it also brings us back to the original question—the chain-gang. I don't know as it's good policy to tell who you are going to promote before they are consulted, but I guess it will be safe this time. You remember that I told you, when the new performance sheet was adopted, that promotions would be made on that, other things being equal? Well, I meant what I said. Who stands at the head of the list, and has stood there from the first?"

"Barney Murray."

"Right, and Barney Murray will be your new traveling engineer. Some of you complained that he had the best engine, had different injectors, patent valves, etc., and that anyone could show a record if given an advantage—that's why I chain-ganged you this month.

"The new sheet will be out the 2d, and you will see that it was not the engine, but the man. Barney Murray will be at the top there, too. Besides that, Barney is an engineer capable of imparting his knowledge to others; his firemen are the best-posted freightmen we have on the road, and he graduates quite a number. He is the man who asked to go with the air-brake car when it came—some of you were ready to sign a petition to send it away. Barney knows you all, is square and fair, and won't expect too much of you. But take my advice and follow him; he can lead you all right; and don't forget that the record is what counts—not your age, or your relationship, or your pull, but what you can do as engineers. You are doing well on fuel and oil; but look out for some of these freightmen; they are thinking and working—sure to do something."

When the men got into the roundhouse again, on familiar ground, they talked over the whole matter and agreed that things couldn't be better. Barney Murray came in to register and was pulled into the circle and congratulated, and just when the good feeling was at its best the "present fiend" arose and said: "I move that we present old Skinney Skeevers with a gold watch for Christmas; he's hot stuff." There were ten seconds to the motion; but Barney Murray held up his hand for silence, got it, and said:

"Boys, Skeevers wouldn't take it; don't you remember five years ago, when a paper was passed for a gold watch for Massey, and half the men on the road had signed it; when it got to Skeevers and he wouldn't sign, and raised such a row that Massey had to order the paper withdrawn? You might pass a resolution, or something, but you couldn't give Skeevers a watch; he won't let you."

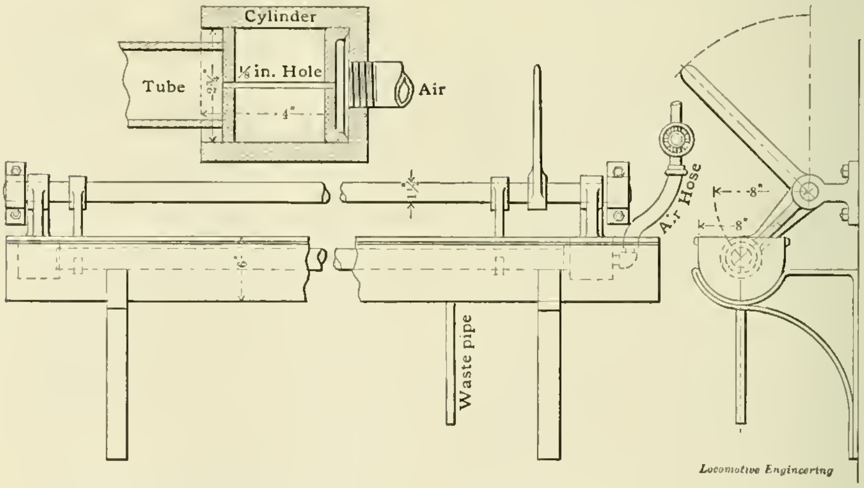
"A testimonial, that's the thing," said one, "engrossed, framed and"——

"Mon," said Sandy Taylor, the roundhouse foreman, who had joined the crowd, "d'ye mind a teestamonial jest till the mind 'o Maister Skeevers? It wad be fra the shape o' a blueprant and framed wi' the reegular frame a the hoose awa'; it's the gude showin' o' savin' coals the mon wants for a teestimonial fra' ye, d'ye mind?"

"Sandy's right," said Milt Smith, looking over his crowd; "we couldn't please Skeevers better than by making a showing on that performance sheet; it's results he wants; that's his success and ours, and I, for one, propose to try to improve my record; and boys, boys, if all of you didn't steal so much coal and oil I would be the bull o' the woods."

As Skeevers went into his office, the "old man" slowly took his feet off the desk, opened the drawer, took a fresh cigar, and said:

"Skeevers, me boy, I came up in a hurry to see you on a certain matter, but I'm going back. I heard what you said to the gang—dead right—couldn't be no righter—you done that almost as good as I'd a' done it myself; all of which reminds me of that true old saying, that there is more ways to skin a cat than to run her through a potato peeler."



Flue-Testing Machine.

There is a flue-testing tool at the East Buffalo shops of the Erie Railroad, that is a departure from traditions supposed to govern that class of machine. It was designed and built by Master Mechanic Moore, who presides over the destinies of those shops.

Flues are tested in this case by air pressure while immersed in water, and the test is accomplished as follows: There is a long rocking shaft which is supported loosely at the ends, in bearings secured to the shop wall. Just inside of these bearings are a pair of arms, and cast on the outer ends of each is a 3¾-inch cylinder, one of which is solid, with a leather gasket, and the other hollow; the latter is at the right of the cut illustrating the device, and the other at the opposite end. The hollow cylinder has a flexible connection with the air supply, and is fitted with a piston 2¾ inches in diameter, having a ⅛-inch hole through it lengthwise. The piston is packed with leather at the air end, and has a leather gasket for the flue end to bear against, similar to that at the opposite end. The air cylinder is shown in an enlarged sectional view above the elevation of the machine.

Below the parts described is a long shallow trough filled with water. In the testing operation, the flue is placed upon a pair of hooked arms connected to the rocking shaft and reaching over the trough. The ends of the flue are placed against the leather gaskets, and it is then lowered into the water by means of the handle on the rocking shaft; air is turned on, and while the piston in the small cylinder holds the flue securely against the leather gaskets at the ends, there is sufficient air passing through the ⅛-inch hole in the piston to put the interior of the flue under pressure. Since the flue is under water, the slightest leak will be at once apparent from the bubbles coming to the surface, due to the air pressure in the flue.

There are no waits for water to empty itself from the flue after the test, as is the case in the hydrostatic methods, and the cleanliness of the operation is attested by the dry surroundings.

The annoyance from incrustation of boilers is so great and it is so costly that ingenuity is constantly at work trying to find out something that will remove the scale or keep it from forming. The latest scale preventer that we have seen is a mixture, consisting of 90 per cent. of soluble chromate and 10 per cent. of soda. These salts transform the soluble carbonates in the water into soluble chromates, which settle in the form of mud without adhering to the heating surface, and can be washed out. It is said that the mixture gradually reduces old incrustation that has been formed on boilers. The boiler of a freight locomotive may be kept clean by using a half pound of the mixture every day.

The Inspector.

We are indebted to Superintendent W. W. King, of the Norfolk & Southern Railroad, for the photograph here reproduced, showing how easily and neatly an old eight-wheeler can be converted into an inspection locomotive. We believe it is perfectly safe to say that one trip of an official over a road "on the head end" is worth three trips made in the coaches. He sees things as the engine finds them and notes their effects. Misplaced signals can never be noticed from the cars and a rear-end view is the wrong point of view altogether.

The more of these little inspectors that carry superintendents, road masters and other officials over the roads, the better it will be for the service.

THE INSPECTOR.

Cutting of Flanges.

One of the most common subjects of discussion at railroad clubs and other places where railroad men meet, is the causes of flange wear of wheels. Some speakers are always trying to find far-fetched causes for this source of accident and annoyance, but we do not think that anyone who stands for a few hours looking at workmen putting car wheels on axles will find much difficulty to explain the cause of flange-cutting. There is not nearly enough care taken in matching wheels to go on axles.

The writer recently had the opportunity to make careful measurements of a great many wheels that were waiting to be put under cars. He very rarely found wheels on the same axle within $\frac{1}{16}$ of an inch of the same diameter. They varied from $\frac{1}{16}$ to $\frac{3}{16}$ in difference. It is a very stupid policy that allows wheels in this condition to be put under rolling stock; for besides the trouble from the cutting of flanges, the uneven size greatly increases the friction, and consequently makes the car resistance greater. It is safe to say that 99 per cent. of the cutting of wheel flanges arises from two causes—wheels unevenly matched and trucks out of square.

Two Kinds of Firemen.

BY ANGUS SINCLAIR.

THE BAD FIREMAN.

Some men are so constituted that they never make good firemen, no matter how much they may try. The average bad fireman is, however, of that quality because he never tries to be a good one. The average bad fireman is careless about how his work is done; indifferent about how his inferiority may cause delay to trains, annoyance to the engineer, or expense to the company. All he cares for is to get through his work with as little personal exertion as possible. It often happens that his efforts to shirk the most necessary part of his work greatly increase his labors before a trip is finished; yet he will go through the same performance on the next run.

When called to go out on a run, the poor fireman reaches the engine-house just as it is time to start for the train. He pitches some coal into the firebox, and sweeps the cab and waters the coal as the engine is on its way to the starting point. As soon as the engine pulls out, working hard to force the train into speed, this fireman pulls open the fire-door and throws in a heavy load of coal. Steam begins to go back and the engineer shuts off the injector. As the fire burns through, the steam comes up; and just as the engineer finds it necessary to start the injector again, the fireman jerks open the fire-door and pitches in eight or ten shovelfuls of coal as fast as he can drop it inside the door; then he climbs up on the seat and waits for the black smoke ceasing to flow from the stack as the signal to get down and repeat his method of firing.

Finding that the engine is not steaming freely under his treatment, he gets down reluctantly and tears up the fire by violent use of the shaking lever. When the train reaches a stopping-place, this kind of fireman occupies himself looking at the sights, and pays no attention to the fire until the signal to start is given, when he throws open the door again and repeats the operation of firing followed at the first start.

By this method of firing, small mounds of coal are dropped promiscuously over the grates. In intervening spots the grates are nearly bare, and cold air passes through without meeting carbon to feed upon, and not sufficiently heated to ignite with the volatile compounds distilling from the mounds. The product is worthless smoke. Each mound is a protection for the formation of clinker, which grows so rapidly that the shaking-bar has to be frequently toiled on to let sufficient air through the fire to make steam enough for making slow time.

The result of this fireman's way of working is irritation all round. Towards the end of the trip he is overworked, throwing the extra coal needed and the hard shaking of grates. At every stopping-place he has to crawl beneath the engine to clean the ashpan, and is fortunate if the grates are not partly burned. The practical result for this man's employers is that he has burned from 25 to 35 per cent. more coal than a first-class fireman would need for doing the same work.

THE GOOD FIREMAN.

The highest type of fireman is one who, with the smallest possible quantity of fuel, can keep up the required pressure of steam without waste through the safety valves. The majority of firemen try to reach this ideal. A good fireman reaches the engine-house in time to see that all the necessary tools and supplies are on the engine, that the tank is full of water and provided with the coal necessary for the trip. He examines the fire to see that it has a good foundation for starting, and if not, puts in the necessary quantity of coal at several firings, letting the fire burn through by degrees. The ashpan is examined and care is taken to find out that the grates are level.

When the train is ready to start, there is a glowing fire on the grates, sufficient to keep up steam until the reverse lever is notched back after the train has worked into speed. With heavy freight trains this firing is made sufficient, so that the door has not to be opened until the tremendous exertion of starting is over. When the time for replenishing the fire arrives, the good fireman knows either from instruction or by observation that the effect of throwing fresh coal into the burning mass of the firebox is similar to that of pouring a dipper full of cold water into a boiling kettle. The cold coal cools the fire, and if thrown in in large quantities its tendency is to depress the burning mass for a brief time below the igniting point. A small quantity of cold water does not check the boiling of a kettle much, and three or four shovelfuls of coal are little felt on the fire of a big locomotive; so our man throws in only a few scoopfuls at a time, is quite deliberate in applying each charge, scattering it over the surface of the burning mass, so that each portion of fresh supply quickly gives up its hydro-carbon gases and becomes a vital addition to the bed of incandescent fuel. This bed of glowing fuel, on which the fresh coal is thrown, being comparatively thin, a supply of air passes through sufficient to provide the necessary oxygen to the hydro-carbons released, and the gases are burnt with the high generation of heat of which they are capable.

From various causes the fire does not tend to burn evenly all over the grate surface, but thins rapidly in spots. The good fireman, on glancing into the firebox, knows where these spots are, and loses no time in filling them up. The fire is maintained nearly level; but the coal is supplied so that the sides and corners are well filled, for their liability to draw air is most imminent.

REGULATING AIR ADMISSION.

Until he realizes that the supply of air drawn from the ashpan is becoming less than equal to the demands of the fire, this fireman keeps the front damper closed and permits the exhaust to draw in its own supply of air from the back damper. Locomotives deficient in grate area may not steam freely with the front damper closed, even when the fire is clean; but engines of that sort are getting to be exceptional. The blast from the nozzles creates an impetuous draft through the grates; and when to this is added the rapid current of air impelled into the open ashpan by the violent motion of the train, the firebox is found to be the center of a furious windstorm. Unless kept in check, the currents of this storm are liable to do damage to the firebox and tubes when thin spots in the fire permit them to pass up without being properly heated.

SHAKING THE GRATES.

Should indications appear that the fire is not receiving sufficient air, our fireman gently shakes the grates, an operation which is repeated during the trip at intervals sufficient to keep the fire as clean as possible. No act marks the poor fireman so strongly as his method of shaking grates. He does the work so violently and so frequently that a great deal of fuel is wasted. The fire is perniciously disturbed, and unless it is very heavy, holes are made which admit the cold air. Good coal requires no more grate-shaking than what will prevent clinkers from hardening between the grate openings. Coal that contains a great deal of ash will be burned to greater advantage when the grates are shaken lightly and frequently, and this shaking should be done by short, quick jerks. The long, slow movement that some men give the grates, in shaking, merely moves the clinkers resting upon them. The purpose of shaker grates is to provide a means of breaking the clinker, so that it will fall into the ashpan and permit the dead ashes to fall.

AT STOPPING POINTS.

When approaching a stopping place, our fireman takes care to have sufficient fuel in the firebox, so that he will not have to begin firing until the start is made. When this has not been done, a fresh supply of coal should be applied while the engine is standing at the station. The common practice of throwing open the door and beginning to fire as soon as the throttle is opened, is very hard on fireboxes, because the cold air drawn through the door strikes the firebox sheets and tubes, contracting the metal and tending to produce leakage. Firing just as a train is pulling out of a station is bad for another reason—at that time the fireman ought to be looking out for signals.

FIRES TO SUIT THE WORK TO BE DONE.

The good fireman maintains the fire in a condition to suit the work the engine has to do. At parts of the road where there are grades that materially increase the work to be done, he makes the fire heavier to suit the circumstances, but this is done gradually, and not by pitching a heavy charge of fresh coal into the firebox at one time. This system of firing keeps the temperature of the boiler as even as possible, and has the double result of being easy on the boiler and using coal to the best advantage. From the time he reaches the engine until the hostler takes charge at the end of the journey, this fireman attends to his work, and to his work alone. It is only by concentrated attention to the work to be done that a fireman can do it in a first-class manner. The good fireman does not attempt to run the whole of the railroad, including the engineer, when he is making a trip over the road. The inveterate meddler with other people's affairs, who is found occasionally filling a fireman's position, distributes his attentions too thinly to succeed in performing a fireman's duties successfully.

There are circumstances where the method of firing followed would not be a success, because certain coals and certain engines require special treatment. But, in a general way, the methods described are those of the most successful firemen. A man who does the work of firing with skill and intelligence is a promoter of morality and a dispenser of harmony. The engine steams well and is always equal to the work to be done, preventing a great deal of profanity; the meeting-points are all made on time, and a general good feeling prevails towards all the men engaged in operating the train. Each man takes some credit to himself for everything going on so comfortably, but the principal meed of praise belongs to the fireman.

Character of Air in Underground Railways.

One of the best illustrations we know of the conservative habits of railway managers in Great Britain, is the atmospheric condition of the underground railways in London. The air is so stifling from the combustion fumes of the locomotives operating the system, that weakly persons find it dangerous to ride on these railways. There is no reason in the world why electricity or compressed air should not be introduced as a motive power, except that the management of the railways does not care to incur the expense of making the change.

Dr. Angus Smith, a famous chemist, has lately been analyzing the air found in the underground railways, and he has made revelations that ought to be of great interest to the people who use the lines. Pure air contains 20.94 per cent. of oxygen in 100 parts by volume, and it was found that in the underground railways the pure oxygen amounts only to 20.6. The air in the tunnels is naturally heavily charged with carbon-dioxide gas and some carbon-monoxide, a highly poisonous compound. The nominal quantity of carbon-monoxide gas in the air is .037 in 100 parts, but in the underground railway tunnels this disagreeable gas amounted to .388 per cent.

Eminent chemists have expressed the opinion that atmosphere containing more than .1 per cent of this gas is too much polluted to be breathed with safety. The result can easily be imagined on the health of the people breathing air containing four times the quantity of carbonic-dioxide.

The numerous inventors who are constantly claiming that they were the first to conceive the idea on which some successful invention was founded, and which was perfected by others, ought to remember that the mere idea of what may be done is not patentable. They must devise a practicable apparatus for carrying out the idea. This was very clearly defined by the Supreme Court of the United States years ago in giving a decision sustaining the validity of the Richardson safety valve. Others had attempted to make pop safety valves before Richardson patented his device, but his was the first one that worked successfully. The court held that Richardson's inventions had not been anticipated by others, and that he was the first person who made a safety valve which, while it automatically relieved the pressure of steam in the boiler, did not in effecting that result reduce the pressure to such an extent as to make the use of the relieving apparatus practically impossible, because of the expenditure of time and fuel necessary to bring up the steam again to the proper working standard.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Odd Answers to Air-Brake Questions.

A prominent air-brake inspector and instructor sends us the following dialogues which actually took place. The following is probably a slip of the tongue, or perhaps the dangerous use of a doubtful word:

Instructor—"Now trace the air from the train line back."

Answer—"Through the triple to the auxiliary, from the auxiliary through the triple to the brake cylinder, when the brake is set, and when released, from the brake cylinder through the triple to the hemisphere."

The next is more than a slip of the tongue or a misuse of a word:

Instructor—"What causes the jar on a train when making station stops with a passenger train?"

Answer—"The rush of air from the main reservoir to the train line."

This man was positive, yet shaky and erratic:

Instructor—"What would you do if in looking over a train you found a retaining valve gone and a plug put in the end of the exhaust pipe?"

Answer—"Any man would be a —— —— fool if he left that in!"

Instructor—"Well, what if you were looking over a train and a retaining valve was missing and a blow were coming from the exhaust pipe?"

Same man answers—"Plug it up."

In the following the man was learning, but was wrong in the cause:

Instructor—"Which gives us more braking power, a long or short piston travel, and why?"

Answer—"The short one, because the long one has to go farther."

This man had been there:

Instructor—"Would a brake work just as well with the retaining valve gone?"

Answer—"Yes, as far as setting and releasing is concerned; but [interruption] it would not, for we had a car the other day with a retaining valve gone, and I whittled plugs all the way down the hill and couldn't make it work. They blew out as fast as I put them in."

Pressure and volume bothered this man:

Instructor—"If you don't drain your main reservoir after each trip, and the water accumulates in your reservoir until it is half full, how much pressure will you have there when you are charged up and the pump stops?"

Answer—"Forty-five pounds."

Instructor—"Why so?"

Answer—"Because we only have half the room."

The instructor was evidently hard to please, so thought this man:

Instructor—"We are all charged up now, what must we do to set the brake?

Answer—"Pull the conductor's valve."

Instructor—"Yes; but what does that do?"

Answer—"Sets the brake."

Instructor—"Yes; but how?"

Answer—"By pulling the cord."

Instructor—"Oh"

This man was wide awake to the company's interest, but had a long way to travel yet:

Car Inspector—"Mr. Instructor, Oi wud loike ter ask yees a quistion."

"All right, sir; you may."

"Well; it was loike this. A passinger care came to our road the other day, and a blow was coming out of a little round hole in the thriple. Oi woudn't accipt the care unless they put a bolt in the hole. Was Oi roight?"

Air-Brake Items.

"Keep the main reservoir drained," especially in this kind of weather. Also keep the hose hung up properly in the dummy coupling.

Preventing hose from kinking by allowing them to drag is one thing; scooping up snow which freezes in train pipes and triples is another.

The time required in a yard to make up a train so all air-braked cars are ahead, is time well spent. The cost of the extra labor will very often yield a thousandfold return by preventing costly accidents while the train is en route.

Thawing out a frozen triple valve only temporarily relieves the trouble. The water remains and is likely to freeze again. Frequent drainage of the main reservoir, and preventing the hose coupling from scooping up snow, will keep the water out.

A strainer for air-brake couplings has been patented by George H. Herbert, of Anaconda, Mont. It consists of a circular pocket of gauze wire which fits inside the gasket of the coupling. The purpose of the invention is to exclude dust when the coupling is hanging loose.

Those men who bore out the exhaust part of the triple valve to get a quicker release of brakes, lengthen the reversing slide-valve rod in the pump, and otherwise put on the finishing touches (?), would do well to read a correspondent's article on change of air-brake standards in this number.

Switch ahead, couple up and use all braked cars. Not only can a shorter stop be made, which an emergency may demand at any moment, but expensive wrecks caused by break-in-twos, where the rear end collides with the head, may be prevented if the train-pipe can be broken at the same time the train parts.

Faster time can be made on suburban and accommodation trains by releasing the brakes in time to avoid the shock. Passengers will then be up in the aisles ready to unload; but on roads where rough braking is common, passengers will not get out of their seats until the train comes to a standstill and the shock is over.

It is a pretty hard trial on an engineer's temper to have to stop after being signaled to go, in order that a tardy passenger may get on or off. Especially is this true when the train is heavy and the time fast. But a loss of temper and use of the emergency does not help matters. Keep cool. Grin, if possible, but maintain your reputation as a smooth braker.

A correspondent writes good reasons why hose should not drag through the snow, thereby inviting a stoppage in the train pipe. A frozen obstruction in a train pipe is to be more dreaded than a closed angle cock. The latter can be discovered at a glance and remedied, but the former does not usually manifest itself until an attempt is made to stop.

Some time ago a cast-iron brake shoe, having small pieces of wood inlaid, was experimented with and gave some very good frictional results. The wood, however, charred when the brake shoe heated up and would loose out. To overcome this defect, the manufacturer has substituted cork with improved results. This type of brake shoe is well adapted for street-car use, and is claimed to have given good service on a steam railroad.

Air brake men will be deeply grieved to learn of the death of D. L. Barnes, the notice of which appears elsewhere in this number. Mr. Barnes was in the foremost rank of mechanical and civil engineers, and a most successful and brilliant future was seemingly in store for him. He was a member of the Air Brake Association, and gave to it his encouraging support in the trying days of its early existence. The friends made at the St. Louis convention will ever cherish the memory of this brilliant and magnetic man.

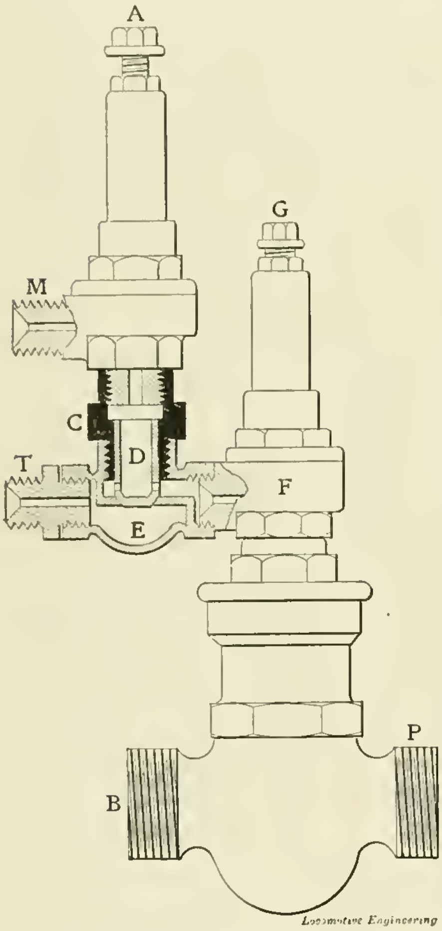
CORRESPONDENCE.

Utilizing Old but Serviceable Material.

Editors:

At this terminal we use four transfer engines which transfer from the C. & O. to several roads in Cincinnati. In performing this duty they are ofttimes required to remain from 20 to 30 minutes on the Cincinnati end of the Ohio River bridge, which has a very steep grade.

These engines are equipped with the D-9 pump governor and D-8 brake valve. With this style of brake valve, when the brakes are applied and left on lap position, the pump is allowed to accumulate



a very high pressure in the main reservoir. I have seen it as high as 135 pounds. When the brakes are released, this high pressure of air is allowed to be thrown into the train line, not only overcharging it, but straining all the weak points, and destroying the sensitiveness of the governor.

We are applying the improved governors and brake valves as speedily as convenience permits, and I have taken steps to utilize the old governors on these engines by combining two diaphragm bodies as shown in the accompanying sketch.

Check valve body *E* is the body of a ⅜-inch globe valve, tapped to fit the diaphragm body *F*. *C* is a nipple and guide for the check valve *D*, which performs the functions of a check valve, piston and reducer, and is made of an excess pressure valve of the D-8 brake valve, with two small holes drilled near the seat to prevent the main reservoir pressure from gaining admission too suddenly to the diaphragm of the train-line governor.

The train-line connection is made at *T*, the pressure passing under the check valve *D* to the diaphragm body *F*, and is adjusted by regulating nut *G*. Main reservoir pressure is admitted at *M*, and is adjusted by regulating nut *A*. In conjunction I use governor filter such as was exhibited at the convention of Air-Brake Men in St. Louis two years ago.

P. P. Haller,
A. B. Insp., C. & O. R. R.,
Covington, Ky.

Leaking Train Pipes.

Editors:

The train pipe is a part of the air-brake system that is being overlooked to a great extent, especially on freight cars. There should be an effort made to apply train pipes to cars in such a manner that leakage could be reduced to the lowest possible amount, as leaking causes a great deal of trouble. An engineer cannot make a good stop if the leaks amount to much from pipe or hose or hose gaskets.

I notice a great many hose gaskets that have the flange that fits in casting beveled. Inspectors do this with a knife to make it go in easy. This causes a leak hard to locate, as the face of the gasket looks good. This practice should be stopped.

Another bad plan for leaks is where the two sections of train pipe connect. Rubber is generally used for gaskets, and as it will not stand pressure perfectly, there is a leak to some extent all the time. Then we have leaks where the cross-pipe from train pipe to triple connects to train pipe, and also at elbow joints to same. This elbow could be done away with, and the pipe be bent. Again, where the pipe connects to the triple valve a rubber gasket is used, which soon gives with pressure, and leaks.

My experience is that leather is the best for gaskets. I have had engines run with leather gaskets for as long as two years, or until returned to shop, and never bothered with them giving out or leaking. I would recommend their use in all joints except where the discharge pipe connects to the air pump. At that point a gasket cut the proper size from sheet asbestos, gives the best results, and will not contract the opening when tightened up. If leather is used for gaskets at all points in the train pipe where a gasket is used, the train pipe be fastened solid to body of car so the pipe will not be pulled forward and back again in cases where the train parts at that point, the auxiliary and brake cylinder be kept tight on body of car so they will not loosen the joints to cross-over pipe (and, by the way, you won't find one freight car out of fifty, that has been out of shop very long, that is bolted solid), and the pipe be bent instead of using elbows, this trouble of leaky train pipes will be stopped. I believe the saving in hose alone will almost pay for this trouble, from the fact that with fifteen or twenty cars leaking badly, the heat generated by the air pump will sometimes affect the first two or three hose on front end of the train and rot them out so they are not air-tight, especially in cases where the pump becomes overheated and an excessive amount of oil is used. An air pump will supply almost any number of cars that do not leak as easy as ten that do leak.

Another point is the bleed cocks. A great many of them leak, which is equally wasteful as a leak in the train pipe. When brakes are applied, this one leaks right off, and then draws the train-pipe pressure down, besides wasting a great deal of air when brakes are released. It must be remembered that a leaking train pipe destroys the graduating feature of the triple valve till the brakes do not go on with a violence equivalent to the emergency; yet the application is taken out of the engineer's hands, and it takes a good deal of brains to figure the leakage and the grade you may be making the stop on, so as to make a nice stop Also, it is hard on the car bodies, as they crowd together harder than they would if the brakes applied slower.

Private cars give us the most trouble, as they do not seem to be very well cared for. Then we have a great many cars equipped with a style of brake that will not work; they may comply with the law, yet they will not stop the car. They only bother the rest of the brakes if allowed to be cut in. They are better cut out.

I. H. Brown,
C. & O. Ry.
Covington, Ky.

Danger of Allowing Hose to Drag.

Editors:

Every air-brake instruction book I ever read, every instruction I have ever heard, and almost every reference made to the main reservoir, contains that old stereotyped charge: "Keep the main reservoir drained." I am finding no fault with the charge in question. It contains good sensible advice, and is well put.

Water in the main reservoir usurps space properly belonging to the system for releasing and recharging brakes. Main reservoirs are never too large, nearly always too small, and have no room for water. Again, and really more important than the preceding, the water contained in a main reservoir gets back into the train pipe and triple valves and, in cold weather, freezes. We who have held a torch under a frozen triple to thaw it out, or have followed the train pipe from the front end to rear end of car with a blazing piece of kerosene-saturated waste on the end of a packing hook in freezing weather, appreciate the importance of keeping the main reservoir drained. But when I see air-brake hose dragging through the snow, the opening in the head entirely closed and clogged, as I did in our Boston yards during the late snowstorm, I am impelled to ask if keeping the reservoir drained to prevent freezing up of triple valves and train pipes, and allowing snow to enter through the hose, is not equivalent to barring burglars by locking the front door and permitting the rear door to stand wide open?

The old stereotyped rule, "Keep the main reservoir drained," is all right as far as it goes. But it only guards one end of the line. Something is needed at the other end. Brakemen may knock the coupling heads together to dislodge the loose snow, but in zero weather they will not clear out the packed snow and ice. Is there no way by which brakemen and others can be compelled to hang up the coupling in the dummy, where it belongs? This is a serious question that deserves due consideration.

AMOS JUDD.

Boston, Mass.

Instruction Room Device for Showing Movement of Quick-Action Triple.

Editors:

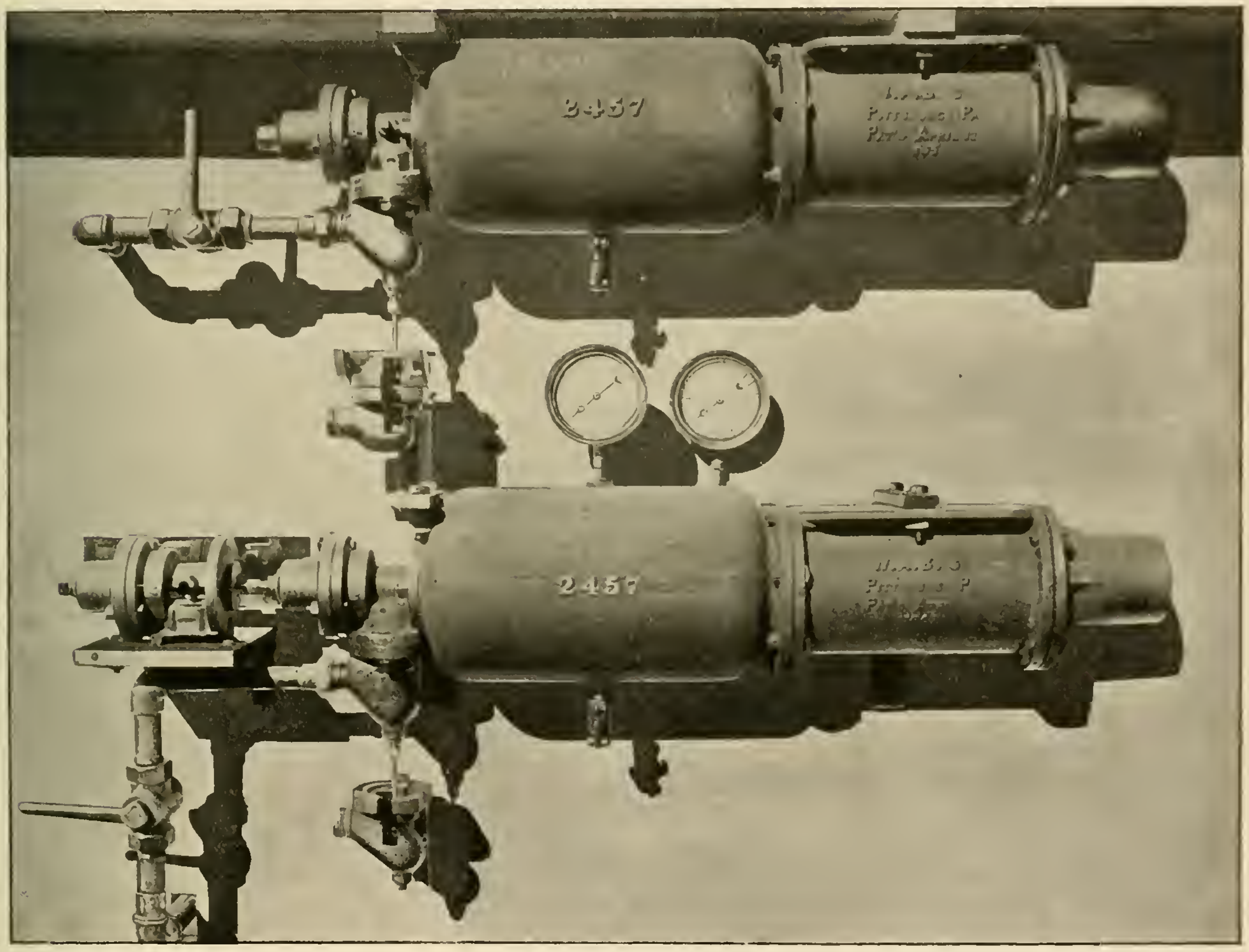
Under separate cover is being sent you a photograph of a device for showing the action of the quick-action triple valve. Mr. Decker, air brake inspector of the Southern Pacific, and myself, through the kindness of Mr. Small, superintendent of motive power and machinery, got this scheme up, and it is now in the engineer's room in the Sacramento roundhouse. From the photo it will be seen that the device is made up mostly of wrecked material.

On the upper triple we drilled a hole through the emergency check valve, and screwed the ¼-inch steel rod into the emergency valve. Then below we took an old triple, and cut it off down to the slide-valve seat, and drilled a hole so that the rod would strike the emergency piston in the center. This shows the movement of the emergency piston and emergency valve.

On the lower brake the rod is fastened to the emergency check valve, and shows the movement of that valve. We then have a triple with both sides cut out, and a piece of looking-glass behind it to show the movement of the slide valve, graduating valve and piston. We have an E-6 engineer's brake valve, and piping to represent a tender, and piping, and hose and couplings to represent two 34-foot cars. This scheme works well, and is an excellent means of showing the action of the triple valve.

H. C. FRAZER.

San Francisco, Cal.



Observations and Suggestions from Florida.

Editors:

I would like to suggest a remedy for the troubles of many, as explained by Fred. M. Tait in the December "Locomotive Engineering." I would say that all engines should have pressure-retaining valves on both tender and driver brakes. They should be spring valves, so made that they could be easily and quickly adjusted to retain from 15 to 25 pounds, and so placed that the engineer could use them without leaving his seat.

Referring to an article in same number by C. O. Mikle, in regard to proper attachment for governor with D-8 valve, will say that it seems to me it would be a good idea to use a Westinghouse double governor, and pipe one to train line and set to 70 pounds, and pipe the other to main reservoir and set to 95 or 100 pounds. Set excess pressure valve to carry 10 or 15 pounds. There is no need of carrying more excess on short trains on levels, for the reason that when valve handle is carried to service application on lap position, the pump starts pumping additional excess, and when it runs up to amount that governor for main reservoir is set at, the pump will stop. The 9½ inch pump will make 10 or 15 pounds additional excess pressure while making a stop. With the double governor, the faults of both the D-8 and E-6 valves could be remedied without carrying high excess pressure, and would be easier on the pump.

Orange Pound,
S. F. & W. R. R.

Bartow, Fla.

Pump Governor Connection for D-8 Brake Valve.

Editors:

In reference to C. O. Mikle's article in December number, it would seem that time and experience has quite thoroughly settled the question of what pressure should operate the air-pump governor, and to resume discussion on the subject now would be untimely as well as uninteresting. There are many other important matters that demand air-brake men's attention. However, after all that has been said and written on the subject, we find that facts and conditions exist, about as follows:

The pressure most necessary to govern is the train-line pressure, for that is the base upon which the braking power is calculated. That we may have freedom from slid flat wheels, the train-line pressure must be properly and unmistakably governed. It must, therefore, be governed directly. If there is but one governor, that governor must govern the train-line pressure. If we wish to govern the main reservoir pressure (and I hold that that pressure should also be governed), we may govern it either indirectly through the medium of the excess pressure valve, or directly with a second or additional governor, as a few pounds variation will cause no damage. But the train-line pressure, the all-important pressure, should never be subordinated in government to the main reservoir pressure, such as would be done by attaching the governor to the main reservoir and controlling the train-pipe pressure through the medium of the excess pressure valve.

The feed-valve attachment on the E-6 brake valve is not only an automatic feeder to supply the train pipe with pressure lost through leakage, but is also a governor valve which governs the train-line pressure when the valve is in running position. As this valve directly governs the train-line pressure, and as there is no use for two governors for one pressure, we may now remove the pump governor connection from the train-line pressure and attach it to the main reservoir to govern that pressure, thus giving us two governors which govern directly the main reservoir and train-line pressures, respectively. But if the use of the feed-valve attachment were discontinued, and an ordinary excess pressure valve substituted, then we would be obliged to change the pump governor from the main reservoir pressure to the train-line pressure, as the latter pressure is the most important pressure of all and must be governed directly.

I notice one road running into this city which has still in service quite a number of D-8 brake valves. Engines so equipped have a combination governor consisting of one body and two tops. One top is connected to the train-line pressure and set at 70 pounds, and the other to the main reservoir pressure and set at 90 pounds, thus controlling directly and certainly both of these pressures. The inevitable uncertainties of operating through a medium are thereby avoided.

I trust I may be pardoned for dwelling at such length upon a subject which I characterized as uninteresting, but I have been prompted to write in this manner, believing that Mr. Mikle's communication should have a reply.

Amos Judd.

Boston, Mass.

Tampering with Air Brake Standards.

Editors:

It is quite evident to those who frequently come in contact with men who do air-brake work, or who handle air brakes, that tampering with air-brake standards is of too frequent occurrence, and results in improper performance of the brakes, and not infrequently is the cause of mysterious manifestations which confront the men operating them.

The writer has many times been called upon to unravel the trouble with a recalcitrant air pump, locate the cause of quick action when the locomotive and cars were apparently provided with the latest proper standards, or started on the trail of some ignis fatuus which had disturbed the equanimity of those who had made a vain search for something that did not exist. It might properly be remarked here that while this last remark does not really apply to the subject, still it is among the mysteries of fancied erratic brake action.

As a general proposition, it may be remarked that perfection, and perfection only, is what everybody expects in brake performance, and if a near approach to this is to be obtained, it is self-evident that the brake apparatus must be in a most perfect condition to contribute to this result in the highest possible degree.

In the design and manufacture of air-brake apparatus, every detail is most carefully considered. In addition to this, nothing is put upon the market until such time as it has been thoroughly tested and closely watched in actual service, and every possible effort made to definitely determine what the requirements are that must be embodied in the part. It is possible that, under some conditions of service, certain details of the present standards might be, to some extent, changed, and no one understands this better than the company manufacturing the apparatus; but it must be borne in mind that nothing pertaining to railroad equipment is subjected to such a variety of conditions, under all of which the mechanism is expected to work equally well, as the automatic air brake; hence, the importance of not tampering with the devices which are especially adapted to conform to all those varying conditions of service.

In what has been said, the endeavor has been to point out the importance of never changing, in any detail, the vital parts of the air-brake apparatus, whether it be the pump, governor, brake valve or triple valve; but to make these remarks more comprehensive, a few of the many departures sometimes made from the standards may be properly noted.

The preliminary exhaust port of the Plate E-6 and D-8 brake valves is one of the vital points in controlling brake application, and its size must be rigidly maintained to insure expected results. When, as a fact, it is stated that an increase of 1-32 inch, or even less, in the diameter of this port results in a quite radical change in the brake valve's performance, under the varying lengths of trains upon which the brakes are worked, it is obviously apparent that the standard size of port should not be changed.

Incidentally it might be said that in cleaning out this port, no metal tool should ever be used which would have a tendency to ream out and enlarge the aperture. The idea that a larger preliminary exhaust port facilitates the application of the brakes is a pernicious one, for the only effect likely to follow such enlargement would be an emergency application of the brakes when such was neither intended nor desired.

To some, the escape of air through the relief port of the E-7 and E-8 pump governors (an apparently needless waste of pressure) impels them, in their efforts to promote economy of air, to plug up the port. This act may result in the pump failing to start after having been stopped by the governor, regardless of a reduction of pressure in the main reservoir or train pipe, and invites possible disaster from a lack of air pressure when such is required.

The feed port in the triple valve may also be cited, for its size has been determined upon after careful experiment, and a departure from this size will doubtless cause trouble sooner or later.

Sufficient has been said, perhaps, to give the reader an understanding of the object sought to be pointed out in this article, though the changes sometimes made might be carried to far greater length, with convincing reasons why, in every instance, the standard should not be departed from, and the undesirable results that would follow such departure. The one object sought, however, is to impress on the minds of those interested, the importance of not tampering with the standards.

In conclusion, I would add that I quite agree with my friend who reads this and mentally remarks that he has done some of the very things criticised, and has not observed the alleged troubles; but bear in mind that some of the very troubles which you have encountered, and could not successfully combat, have been directly or indirectly the result of tampering with a vital part of the air brake.

If such trouble has not been experienced, do not assume that the particular conditions which would contribute to such a result are not liable to appear at any and the most unexpected moment.

S. J. Kidder.

Chicago, Ill.

QUESTIONS AND ANSWERS

On Air-Brake Subjects.

(1) A. R. L., Louisville, Ky., asks:
Does the mere heating of an air pump reduce its capacity for making air? A.—Yes. There is a loss in pressure which is delivered hot and is cooled.

(2) J. A. J., Nashville, Tenn., asks:
Is there any substance that could be used on air-hose packing ring that would prevent groove in coupling from rusting and not rot the rubber? A.—Yes. Clean the groove out well, and use a little graphite.

(3) A. B. C., Wilkesbarre, Pa., asks:
What will cause signal whistle to rebound upon a reduction of signal-line pressure? A.—A loose diaphragm stem. By lowering the stem about a thirty-second of an inch into the bushing will correct the trouble.

(4) A. R. L., Louisville, Ky., asks:
Will the 9½-inch pump make more air than the 8-inch? If so, how much? A.—Yes. With the same steam pressure and other conditions being equal, the former will compress about 60 per cent. more pressure than the latter.

(5) J. A. J., Nashville, Tenn., asks:
In working quick action, is the increase over a service application as great with extra large piping as where the ordinary pipe is used? A.—Yes. A large train pipe will contribute more pressure to the cylinder in an emergency application than a small one.

(6) E. A. M., Albany, N. Y., asks:
Will you please explain in full in your January number the construction and workings of the reinforced brake used on the "Empire State Express" and other fast trains? A.—On page 184 of February number a full description is given of the high-speed or reinforced brake, as it is sometimes called. This brake stops a train is about 25 per cent. shorter distance than the ordinary quick-action brake.

(7) A. B. C., Wilkesbarre, Pa., asks:
With D-5 brake-valve handle in running position I could obtain no excess. Gaskets "O. K." What was the trouble? A.—Possibly the adjusting nut on the feed valve attachment was screwed up too far. Again, maybe the spring case of the feed valve attachment was screwed up so tightly as to cause edges of the gaskets to crush and allow the piston to force the supply valve off its seat. Possibly the supply valve did not have a tight seat.

(8) R. L. J., Cincinnati, O., asks:
When backing a train having ten air cars and twenty-five non-air, out of a side track, is it better to hold the train with hand brakes or to let the engineer do the holding with his air brakes? A.—While a careful engineer can safely do the holding under the circumstances, it would perhaps be better to set the hand brakes next to the caboose, thus keeping the slack bunched. A harsh application of the air brake by the engineer is liable to break the train in two, in a similar manner that hand brakes on the rear end, when making a forward stop, are liable to do.

(9) G. E. R., Mattoon, Ill., writes:
We have a few of the small brass engineer's valves that have been in use here ever since they were put on the market. When you make a reduction of 5 or 7 pounds you can hear no escape of air at all from the valve, and it makes the reduction so suddenly that with a train of quick-action triples you get the emergency action when you do not want it. What makes these valves act this way? A.—They are worn out, and good braking cannot be done with them until they are repaired. The better plan would be to replace them with modern equalizing discharge valves.

(10) J. A. J., Nashville, Tenn., asks:
Of what advantage or why are check valves placed in pipe between pump and main reservoir, when either one or two pumps are used? The valves in these checks are much lighter than the pump valves, and are not as readily accessible for examination. A.—There is no advantage gained by using check valves as described. The discharge valves are all the checks that are needed, and any more are useless, and only serve to collect matter that reduces the size of opening through which air flows and contributes to the heating of the pump. Where check valves are found in the discharge pipe, they should be taken out.

(11) G. M. N., New York, asks:
Of what advantage to the air pump is the steam that goes to the top end of the reversing-valve rod other than lubricating? A.—A small direct port connects the chamber in which the top end of the rod works with the top end of the main steam cylinder, thereby giving the same pressure on the top end as on the bottom end of the rod. On the down stroke, live steam is on both ends of the rod. On the up stroke, exhaust pressure is had on both ends. If there was live steam on one end of the rod and exhaust steam on the opposite end, there would be a tendency for the rod to be forced in the direction of the weaker pressure by the stronger pressure alone, and reverse the pump without the assistance of the reversing plate.

(12) W. W. U., Bloomington, Ill., writes:
When making a service application the brake will hold until released; but when a direct emergency application is made, and the brake valve handle placed on lap, the brake will release. What is the cause of this? A.—We presume that this occurs on the light engine and tender. In the emergency application the equalizing reservoir pressure is not used and leaks past the packing ring in the equalizing piston into the train pipe, and increases that pressure higher than that in the auxiliary; consequently, the brake will release. If the brake whistles off through the triple, the brake has been released by an increase of pressure in the train pipe. If it slips off silently, there is a leak past the leather packing in the cylinder.

(13) W. B. M., Columbia, Pa., writes:
For what are those two small pipes leading from the train-pipe connection of the brake valve to the cut-out cock in the main reservoir pipe that is being put on our freight engines? A.—We presume you refer to the cut-out cock adopted and used by the Pennsylvania Railroad. This cock is placed in the main reservoir pipe under the brake valve so the second man on a double-head train can use the emergency brake if necessary. Two small pipes connect with train-pipe exhaust angle fittings. When the cut-out cock is open, the train-pipe exhaust is made through one small pipe. When the cock is closed, the service application cannot be made, but the emergency can. The second pipe allows train-pipe pressure to be recorded on the gage of the second engine. We will illustrate this cock next month.

(14) G. E. R., Mattoon, Ill., writes:
I am using a D-5 valve which has been in service eighteen months. I have had the feed valve down frequently and cleaned it, but it is very erratic in its action. Sometimes the gage shows 60, 70, 80, etc.; and it is a sure thing, if the train line shows 80 or 85 with light engine, and I couple onto five or more brake cars, it will drop to 50, and I will have to use the tension nut on feed valve to increase the train-pipe pressure. I would like to know what the trouble is and have it repaired. A.—The edges of the gasket have been thinned by taking down and screwing up the feed-valve attachment so frequently. Put in new gaskets, and when the valve needs cleaning, take out the supply valve by removing the cap nut, but leave the bottom part alone. Possibly dirt on the supply valve has caused some of the trouble.

Every year or two some inventor proposes to take the air for the ventilation of railway cars from the front of the locomotive, and thereby prevent the entrance of smoke and cinders to the car through the openings usually left for air to get in. It seems to be a very attractive way of doing the work, but somehow cars have never been ventilated in this way, although the patented appliances offered for the purpose are beyond number. The latest candidate for disappointment in this line of human effort is Joseph I. Dunlap, of Wadesborough, N. C., who proposes to run a pipe over the top of the locomotive and cars, right through to the end of the train, the front opening being a bellmouth attachment, intended to take in as much air as possible and force it through the pipe. Inventions very much like this have been repeatedly offered before, but we never heard of one being tried. On the face of it, the invention would be a nuisance and would add very materially to the labor of keeping train mechanism in order.

Lake Shore Ten-Wheel Passenger Engine.

The ten-wheel passenger engine shown in the annexed engraving is an improvement on the old passenger ten-wheelers of the Lake Shore & Michigan Southern, worked out by Mr. Geo. W. Stevens, superintendent of motive power for the company, and built by the Schenectady Locomotive Works.

The engine has cylinders 18 x 24 inches; boiler, extended wagon top, 56 inches diameter in the front ring; and driving wheels, 68 inches diameter.

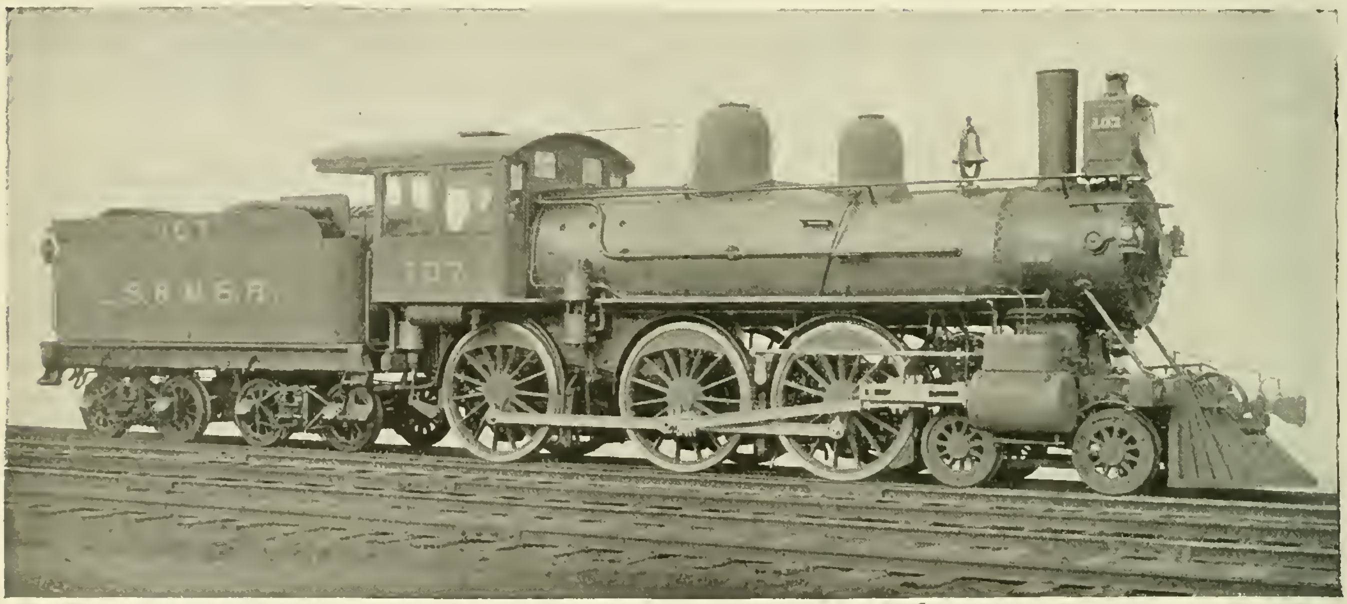
A series of very difficult engineering problems were involved in the designing of this engine. It was desirable to produce a locomotive of considerably greater power than the old ten-wheelers, but the mechanical department was bound down to a total weight of 118,000 pounds, which is about the same as the weight of the old engines. The work was, however, carried out successfully, and this engine has 1 inch greater diameter of cylinder, 2 inches more diameter of boiler and has 263 square feet more heating surface than the old type. When people proceed to design a new engine, it very often happens that the real weight comes out very differently from what was calculated upon; but this engine was an exception, for when put upon the scales in working order, it came within a few hundred pounds of the specified weight. This displayed unusually skillful designing. It was determined from the first that the process of lightening the whole engine should not reduce the strength of essential parts—like frame, rods, axles, etc. The reduction of weight was effected to a great extent by improved forms, and the use of stronger material, such as steel and malleable iron castings.

The driving-wheel centers are steel, cored out at every point where this could be done consistently with maintaining strength. All the rods are channeled out and made as light as possible, even the top of the guides being channeled; over 50 pounds weight has been taken out of the cross-heads alone, due to coring it out. The crank pins are made of Krupp steel and are also hollow. All castings and the front end of the smokebox are of pressed steel, and steps, braces and other parts, formerly made of cast iron, are of malleable iron. The various casing covers, which are pressed out under the hydraulic press in the works, are notable for their graceful forms. While the reduction of weight has been carried as far as possible, no expense on work or on material has been spared to make the engine efficient and durable.

The valve motion gives a very good distribution of steam, especially considering the shortness of the eccentric rods. With ten-wheel engines it has generally been considered necessary to place the links in front of the drivers and span the axle with the eccentric rods, or to make a very complex arrangement of transferring motion from links to rockers. This was considered necessary to prevent undue lead of valve when the links were notched up to cut off short. In this case the links are placed between the front and main drivers, making a very short eccentric rod; but by good designing and peculiarity in valve-setting, the distribution of steam is as good as it is in the ordinary eight-wheeler. When linked up to cut off at six inches, the lead opening is only $\frac{6}{16}$ inch. The valves are set $\frac{1}{16}$ inch blind in forward motion, and $\frac{9}{64}$ inch in full gear back. The valve rod of this motion is unusually long and looks heavy, but it is really light, for it is made of steel tubing. The links have a remarkably wide bearing surface, and, indeed, all the rubbing and wearing parts are of very liberal proportions. The hangers connect with link suspension pins about 8 inches long, and the upper rocker pins are about the same length between head and washer. The outside of the tires is polished.

The frames are wonderfully substantial, considering the lightening process that the engine has undergone; the part that extends from the front joint to the front of the cylinder is 7 inches deep. The guides are of the double-bar style, and are secured in front to lugs cast on the back cylinder head, and in the back by cross-braces 1¼ x 8¼ inches.

The firebox is set above the frame and is held up by swinging hangers on each side, with expansion pads at the front corners, and a single pad extending nearly the whole breadth at the back of the firebox above the foot plate. The cylinder saddles have unusually wide flanges, and are bolted to smokebox by five 1⅛-inch bolts on each side and six on back and front, besides two rows of bolts screwed into the saddle from the smokebox side.



LAKE SHORE TEN-WHEEL PASSENGER ENGINE.

Particular attention has been bestowed upon covering every part where heat is liable to be carried away, with material calculated to keep out the cold. The boiler, steam chest and cylinders are covered with sectional magnesia, and, as usual with all Mr. Stevens' locomotives, the front, sides and back of the firebox are carefully lagged. Asbestos cardboard and hair felt are used for the firebox lagging.

Before mounting to the cab, we pause to admire the provision made to enable people to reach the deck and come down from it without danger to life and limb. There are substantial steps that are not a deception to the feet, and handholds that people of ordinary stature can reach. There are also good convenient steps for enabling a man to reach the sandbox and headlight, while the tender has been provided with unusually convenient appliances of this kind.

In the cab we find all the attachments applied with a view to convenience in handling and for safety in case of accident. All the pipes are connected with one "combination globe," which connects with the dome and has an automatic closing valve. The throttle lever, engineer's valve, reverse lever, injector, gage cocks and automatic sanding lever are all within a radius of 18 inches. Immediately in front of the engineer is a small lamp, which he can use to read his orders by or to look at his watch. Besides that, there are lamps for showing water glass and the different gages. The cab has an elevated arch roof, is very roomy, and is put together so that the nuts of all bolts used are exposed for the purpose of tightening.

The main rods weigh 385 pounds each; back section of side rod, 225 pounds; forward section, 189 pounds; crosshead, complete, 150 pounds.

The tender has a pit, sloping forward towards the bottom—a practice which is becoming very common. Wells are provided in front of the tank for the feed-pipe connections. The frame is of steel, and trucks with bolsters of I-beam steel. The water scoop has a novelty in the form of wing-like guards over the dipper, which prevent the water from flying over the truck when water is being let into the tender.

The rigid wheelbase of the engine is 15 feet, and the total wheelbase 24 feet 9 inches. There is 30,000 pounds weight on the engine truck. Dunbar packing is used for the pistons, and they are 4⅞ inches thick, and piston rod is 3 inches diameter. United States metallic packing is used for piston and valve stems. The size of the steam ports is 17 x 1⅝ inches, and the exhaust port 3 inches wide. The bridges are 1⅜ inches wide. The valves are Allen-Richardson, with 1 inch outside and 1 1-16 inches inside lap; greatest travel of valve, 5¾ inches. The driving boxes are of steeled cast iron, and a cast-iron liner is screwed into the wheel hub to prevent cutting. The driving springs are underhung, and are separated by hangers which are hooked to top of box. A. French springs are used throughout the engine and tender.

The main driving-wheel journals are 8 x 9 inches, and the forward and back driving journals are 7½ x 9 inches; the main crank-pin journals are 4¾ x 6 inches; on the main pins the side rod journals are 5½ x 4¾ inches, and the front and back ends are 4 x 4 inches. The engine-truck journals are 5 x 10 inches.

The boiler throughout is built of Carbon steel, and is designed to carry a working pressure of 190 pounds per square inch. The boiler sheets are 7-16, ½, 9-16 and ⅝ inch in thickness; the butt joints are sextuple-riveted, with welt strip inside and out; the circumferential seams are double-riveted. The firebox is 95 3-16 inches long and 41⅛ inches wide; the depth is 67¾ inches in the front and 55¾ inches in the back; the side sheets are 5-16 inch; back sheet 5-16 inch, crown sheet ⅜ inch and tube sheet ½ inch thick. The water space is 4 inches in the front, 3½ inches sides and 3 to 4 inches back. The crown is secured by radial stays of Taylor iron, 1 inch diameter, except the front three rows, which have sling stays. There are 249 charcoal iron tubes, 2 inches diameter and 13 feet 3 inches long. The brick arch is supported by water tubes 3 inches diameter. The boiler tubes provide 1,716.6 square feet of heating surface; the water tubes, 14.7; the firebox, 135.3—a total of 1,866.6 square feet. The grate has 27.35 square feet of area; a Smith triple-expansion exhaust pipe is used; the smokestack tapers from 16 to 17 inches diameter.

There are two No. 9 Monitor injectors and a Nathan sight-feed lubricator for cylinders and air pump. The American brake is applied to all drivers and the Westinghouse to tender. The Gould coupler is applied to pilot and tender. A Hudson bell ringer, Sherburn chime whistle and Ashton muffled safety valves are used.

The engine has a very handsome appearance, and is reported to be giving highly satisfactory service.

ON LOOKOUT MOUNTAIN, TENN., NARROW GAGE, 2,200 FEET ELEVATION. MOCCASIN BEND, TENNESSEE RIVER IN DISTANCE.

Nearly all locomotive engineers are fond of a smart engine, one that will start with a bound when the throttle is opened and run at any speed. Many men are firmly of the opinion that the proper way to make a smart and fast-running engine is to give the valves plenty of lead. Lead will help an engine in starting quick, but it acts against her when fast running is required.

There has been a great deal written of late years about the men who deserve the credit for making a success of the extension front and open front stack of locomotives. When we look over the field of effort and experiment in this line, we think that a good deal of credit is due to Mr. E. M. Reed, who was vice-president and general superintendent of the New York, New Haven & Hartford Railroad at the time of his death. As early as 1863, Mr. Reed, who was then master mechanic of the road, applied an extended smokebox to one of the locomotives, and after a great deal of experiment and changing he made it work successfully. He was impressed with the advantage that must arise from giving the exhaust steam and gases a free passage from the smokebox to the atmosphere, unobstructed by cones or other spark-arresting appliances. A year or two before his death, the writer had a conversation with Mr. Reed about locomotive matters, and he appeared to take greater pride in what he had done to make the extension front a success than in any of his achievements connected with railroad work. He believed that his labors had been the means of saving a vast amount of fuel to railroad companies, and had prevented untold claims for fire damages arising from spark-throwing.

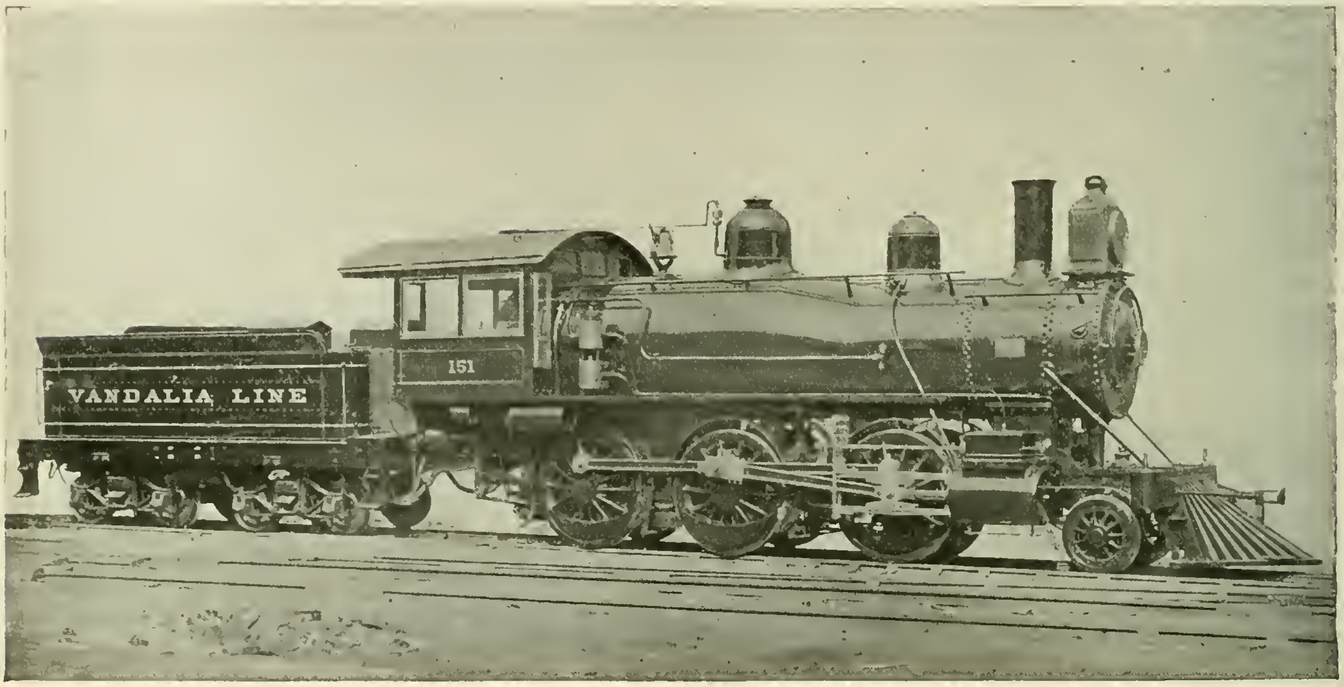
We have received requests to make mention of several scores of calendars that have been issued as standing display advertisements. The number is so great that we cannot find room to mention them all, so we will not discriminate by mentioning any. If any reader wants a calendar, he cannot be far wrong if he applies to any firm handling railway supplies.

Vandalia Line Mogul.

The engine shown in annexed engraving has cylinders 20 x 26 inches; driving wheels, 62 inches diameter outside of tires; boiler, 62 inches diameter at smallest ring and 72 inches diameter at back head.

The crown sheet is supported by 1-inch radial stays. There are 318 2-inch tubes, 12 feet long, in boiler. The firebox is 108 inches long inside and 41 inches wide. In the tubes there are 1,950 square feet of heating surface and 179 square feet in the firebox, making a total of 2,129 square feet of heating surface. The grate area is 30.6 square feet. The working pressure is 185 pounds per square inch. Total weight of engine in working order is 142,000 pounds, of which 127,000 pounds are on the drivers.

This engine is the latest design of Mr. W. C. Arp, S. M. P. of the Vandalia, and built by the Pittsburgh Locomotive Works.



HEAVY MOGUL FOR VANDALIA LINE.

High-Pressure Steam.

Nearly all engineers understand that increasing the steam pressure leads to an increase of efficiency, but exact figures are not easily found. The use of high steam pressures has progressed to a great extent along with the art of boiler-making. At the beginning of this century, 20 pounds to the square inch above atmospheric pressure was very rarely exceeded, and no very rapid increase came about until compound engines began to come into favor.

In a paper presented to the American Society of Mechanical Engineers, by Professor Thurston, on "Promise and Potency of High-Pressure Steam," he gives tables and data which show that the rise in steam pressures from 1800 to 1850 was slow; but since that time the increase of pressure has been comparatively rapid, and the economy of the steam engine has continued to become greater. At the present time the indications seem to be that for some cause, not fully determinable, but very probably connected with the difficulties in securing satisfactory boiler construction, the rate of exhilaration of pressure is beginning to fall off. The pressures have risen from 50 pounds a generation ago to 125 pounds in 1880, to 200 pounds in 1890, to 250 pounds in 1895, and are likely to be above 300 pounds in 1900. This applies principally to marine practice. The author predicts that by the use of water-tube boilers, it will be found as easy to control and utilize 500 and 1,000 pounds per square inch as it is to-day to employ those of 100 to 150.

In a paper, contributed to the Northwestern Railway Club by Mr. J. N. Sanborn, master mechanic of the Brainerd & North Minnesota, he gave calculations which made out that a theoretical saving of 20 per cent. resulted when steam pressure was increased from 130 to 200 pound per square inch. He admitted that there were practical difficulties in the way of realizing this saving with locomotives. Short cut-off and long expansion has always been the theoretical demand, but the practical engine driver says: "I find I can run with less coal by dropping reverse lever down a little and reducing the pressure by throttling, so why are you talking of increasing the pressure?"

Our stationary engine brothers step in here and say: "Yes, we found the same trouble years ago when the Corliss automatic cut-off was invented," and having less obstacles in the way of varying conditions when experimenting, found that the maximum economy was reached when cutting off at one-third to two-fifths of stroke. They discovered that when expanded beyond this point, the variation in temperature of the cylinder walls was too extreme. When steam rushes in from the hot boiler, it finds the cylinder cooled down to approximately the temperature of the exhaust which has just left it. It is immediately chilled, some of the vapor is condensed to water, and the pressure is materially reduced. When the steam is highly expanded and exhaust takes place, the condensed water re-evaporates and acts retardingly on the piston on the return stroke, while the heat reabsorbed from the cylinder in re-evaporation is wasted.

The successful expansion of steam in more than one cylinder has induced inventors to apply the compound principle to locomotives, and some remarkable results have been obtained where high-pressure steam was used in this manner.

The compound locomotive is not greatly in favor among many railroad men to-day; but if they are going to utilize the advantages that come from higher steam pressures, they will be compelled to use compound engines for the purpose. The simple engine with a boiler pressure of 200 pounds is a much more powerful machine than one carrying steam pressure of 150 pounds, and it is doubtful if the higher pressure produces any more economical results when it is used only in one cylinder. The designers and users of stationary and marine engines have shown themselves fully alive to the advantages of high steam pressure, and they are using the best appliances at their command to realize the economy made possible. If the men responsible for the economical operating of locomotives wish to obtain the best possible results from their engines, they will be compelled to follow the example set by other steam engineers.

Provide Uniform Fuel.

Mr. W. E. Amman, locomotive foreman of the Chicago, St. Paul, Minneapolis & Omaha Railway, has evidently made a very thorough study of the numerous causes that lead to the waste of coal. A paper of his on "Fuel as It Is Used and Abused," contributed to the Northwestern Railroad Club, is an exhaustive treatise on the prevailing methods of wasting coal. We have long been forcibly impressed with the belief that one of the most extensive sources of waste of fuel on railroads results from the practices of purchasing different kinds of fuel, that require different adjustments of locomotive draft appliances to burn economically. Roundhouse foremen cannot be changing the draft appliances to suit every quality of coal supplied, and consequently they have to make the adjustment to suit the worse quality of coal, and that wastes fuel when a superior quality of coal is provided.

Under this head, Mr. Amman says: "Only one kind and quality should be adopted, and this standard adhered to. Then engines should be arranged for burning that particular coal. Practical road tests should be made with each class of engine, and the different parts on which combustion depends carefully adjusted. Grates should be made suitable in area and openings for the admission of the necessary amount of air, and of a pattern best suited to prevent clinker or loss of coal by excessive openings. Nettings, diaphragms, nozzle pipes and stacks should be made to conform to the requirements for burning the kind of coal adopted, thus eliminating any necessity for making frequent changes.

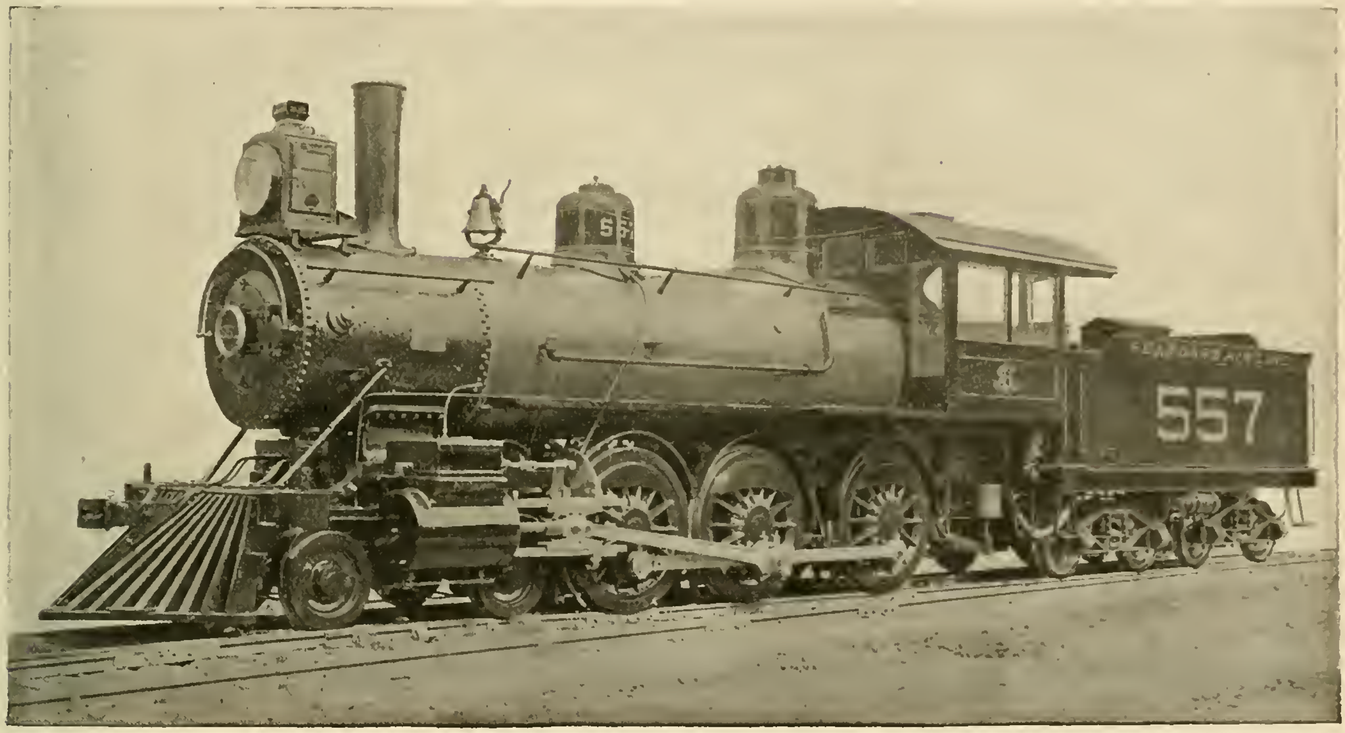
"Where this is impossible and more than one kind of coal is used, each kind should be confined to certain divisions; engines could then be sent to these divisions and appliances so designed and adjusted that the best results could be obtained from the coal used in the district. It is a fallacy to believe that engines can be run over long divisions, or over more than one division, using coal of different kinds and qualities, and produce good results. An engine that is designed to burn one kind advantageously will not burn another kind as well, be it better or worse. Therefore, after a kind and grade have been selected, and suitable appliances for its economical use have been adopted, it is of the utmost importance that these standards should be maintained inviolate, as any departure from either will incur a pecuniary loss to the company.

"The practice of allowing shop foremen, engineers and others to incorporate fanciful ideas in the alterations of front ends and stacks is not good policy, and causes much waste of labor and material as well as fuel."

Seaboard Air Line Ten-Wheeler.

The ten-wheel freight locomotive herewith shown was recently built by the Pittsburgh Locomotive Works from designs of Mr. W. T. Reed, S. P. M. of the Seaboard Air Line.

The cylinders are 19 x 24 inches; driving wheels, 58 inches diameter outside of tires; the boiler is of the wagon-top type, 60 inches diameter at the smallest ring and 67¾ inches diameter at the back head; the boiler contains 239 2-inch tubes, 11 feet 7⅞ inches long. The firebox is 101½ inches long inside, 35⅛ inches wide. The tubes supply 1,448 square feet of heating surface and the firebox 144 square feet, giving a total of 1,592 square feet. The grate area is 23.4 square feet; the working pressure is 180 pounds per square inch.



TEN-WHEELER FOR SEABOARD AIR LINE.

The engine weighs 131,000 pounds in working order, of which 104,800 pounds are on the drivers.

We have seen considerable comment about the rotary engine mentioned in our last issue, which, according to the press dispatches, was to bring a great fortune to its patentee. The newspaper reporters, who gave so much publicity to that engine, seem to think that the rotary engine (one which worked without a crank) was an unheard-of novelty. If these people would pay a little attention to the progress of invention, they would be saved a good deal of ridicule. It may be of interest to more than newspaper reporters to know that in the United States alone there have been about 1,400 patents taken out for rotary engines.

Hedley's "Puffing Billy."

"Puffing Billy," the curious-looking locomotive shown in our chart, was built by William Hedley, of Wylam, England, in 1813, and was the first locomotive to haul cars profitably and to do the work that the builder and owners expected that it would do. The engine is now preserved in the South Kensington Museum, of London.

Before Hedley built this engine, a variety of attempts had been made to construct a steam engine that would travel on land, either on common roads or on tramways; but all these efforts were fruitless of any commercial value. Some of the machines built were able to move on flat plain surfaces, most of them were not able to turn a wheel, and none of them were sufficiently perfected to be recommended as prime movers that would transport passengers or freight more cheaply or more expeditiously than horse-power.

The history of inventions seems to show that when any radical improvement is urgently needed on ancient methods, the man to invent the improvement appears and produces what was wanted. Toys that were run by the force of expanding steam were invented more than two thousand years ago, and philosophers and prophets predicted for centuries that the force generated by the evaporation of water by fire would some day perform the heavy burdens of mankind. Prophecies and predictions led to nothing until, in the fullness of time, a tremendously urgent necessity arose for pumping water out of deep mines. The power exerted by horses had ceased to meet the requirements and a great industry was threatened with ruin. At this crisis (1705), Newcomen and Cawley, two mechanics, of Dartmouth, England, made a steam engine that employed a piston in a cylinder, and gave to the world the principal elements of the steam engine of to-day. But for their crude preliminary work, Watt nor Evans nor any of the other improvers of the steam engine would have found their opportunity.

The locomotive, the electric telegraph, the Bessemer process of steel making, the air brake, the electric light, and all other great inventions have come in the fullness of time—when the world seemed unable to do longer without them. Every radical invention has been heralded by minor inventors who saw the need and tried to provide the invention, but their work did little more than pave the way for the intellectual giant who in due time came along with his masterpiece.

The birth of the locomotive became due when the world's demand for coal grew to be so great that horses ceased to be equal to the task of hauling the loaded cars from the mines to the shipping points. Up till within a few decades England supplied the industrial world with coal. A vast part of England's coal measures are in the northeast part of the country, in the counties of Northumberland and Durham. Newcastle is the capital of the coal kingdom, and near its gates the prototype of the modern locomotive was conceived, built and put successfully to the work of hauling coal cars.

Newcastle, which was a place of some note when the Romans occupied Britain, seventeen hundred years ago, owes its importance to the river Tyne, which is navigable for large ships up to the city. The river traverses the heart of the coal country, and on its waters the coal was carried in barges for shipment at Newcastle. About eight miles from the city is a small place called Wylam, where at one time there was one of the principal collieries in England. In the beginning of this century the proprietor was a Mr. Christopher Blackett, who was a very enterprising man, ever ready to encourage his workmen or others in any efforts made to improve the crude machinery and primitive methods employed in the mining and handling of coal.

Under the labors of Watt and other engineers, the steam engine had been greatly improved for stationary purposes, and inventors began to work on the problem of making it a locomotive. There were a variety of unsuccessful attempts made in the first decade of this century to build a locomotive that would haul cars on rails, and the failures were in a great measure due to an erroneous belief that smooth-tread driving wheels could not be employed, as they would slip without moving the engine. In one very ambitious attempt to make a practicable locomotive, a rack rail was employed, and another engineer tried an endless chain in the middle of the track, to enable the locomotive to pull itself ahead, while a still more radical inventor built an engine that was pushed forward by legs and feet that imitated the action of a horse.

At this time, Mr. William Hedley was what we would call chief engineer of the Wylam colliery. He was a well-educated engineer, which was a rarity in those days, and he devoted a deal of attention to improving the methods for transporting the output of the Wylam pits to the shipping station, five miles distant. His employer seems to have entered heartily into all the plans for improvement proposed by Hedley, and it was this liberal policy which led, after one serious failure, to the building of a successful locomotive.

Hedley had mental independence sufficient to doubt the correctness of the prevailing belief that smooth wheels would not have sufficient adhesion to enable a locomotive to haul a train of cars. To test the matter, he made a variety of experiments, which he described in a letter to Dr. Lardner, an English scientist of some note and much pretension, as follows: "I was forcibly impressed with the idea that the weight of an engine was sufficient for the purpose of enabling it to draw a train of loaded wagons. To determine this important point, I had a carriage constructed. This carriage was placed upon the railroad and loaded with different parcels of iron, the weight of which had previously been ascertained; 2, 4, 6, etc., loaded coal wagons were attached to it. The carriage itself was moved by the application of men at the fore-handles [employed to turn the wheels], and in order that the men might not touch the ground, a stage was suspended from the carriage at each handle for them to stand upon. I ascertained the proportion between the weight of the experimental carriage and the coal wagons at the point where the wheels of the carriage would surge [slip] or turn round without advancing. The weight of the carriage and the number of the wagons also were repeatedly varied, but with the same relative result. This experiment, which was on a large scale, was decisive of the fact that the friction of the wheels of an engine carriage upon the rails was sufficient to enable it to draw a train of loaded coal wagons."

By these experiments, Hedley determined the ratio of adhesion so correctly that for years his figures were taken by engineers as the best authority on the subject.

Having vanquished the bugaboo of wheel-slipping, Hedley proceeded to build a locomotive with smooth wheels. His first attempt was not a success; the engine was a very crude affair, with a boiler of cast iron, with a single tube which passed into the chimney. The engine had but one cylinder, and a fly-wheel was employed to regulate the movement. This crude machine was sufficient to demonstrate certain lines of improvement, and shortly afterwards the "Puffing Billy" was built, and it was at once put to service pulling cars from the colliery to the shipping station. It drew regularly eight loaded cars at a rate of 4 or 5 miles an hour. Other engines of the same kind were afterwards built, and within a year or two, locomotives entirely superseded horse-power in hauling cars on this railroad. The "Puffing Billy" was built in the blacksmith shop connected with the Wylam colliery. It had two vertical cylinders, the power being transmitted by fulcrum levers to gear wheels which engaged gears connecting with the axles of the carrying wheels. The boiler had a return flue, and provided much more heating surface than the boiler of the first locomotive built.

The success of the "Puffing Billy" in hauling cars and doing the work without delay or interruption, excited a great deal of talk and discussion in Northumberland and Durham, and a great many persons went to see the remarkable sight. Among those who witnessed the working of the "Puffing Billy," early in its career, was George Stephenson, then connected with a neighboring colliery, whose proprietors were casting about for improved methods of transporting their coal. Stephenson was a very ingenious mechanic, and on examining the Hedley engine, declared his intention to build a better one. This led to the construction of a locomotive at Killingworth colliery, under Stephenson's supervision. The machine was put to work the following year. The performance of the early Stephenson locomotives compared very unfavorably with those that Hedley constructed. The "Puffing Billy" is a small, crude-looking machine, but it possesses all the elements of the modern locomotive except the multi-tubular boiler. To appreciate the great work done by the designer, we must remember that the whole of his efforts were without aid from anything that had been done in the same line before. He had to work out proportions for himself, just as he worked out facts concerning adhesion. The leading defect of the first engine was want of steam, and this he rectified in the second one by materially increasing the heating surface. The complex form of transmitting power to the driving wheels was made necessary by the weak track on which the engine worked, and which required a long distribution of weight. With all its obvious faults, Hedley's "Puffing Billy" was a triumph of good designing in a field where no precedent existed, and the builder has the undoubted right to the credit of being called "The Father of the Locomotive Engine."

The Weak Draft Gear.

In talking, at the Northwestern Railway Club, on "Draft Gear," Mr. E. A. Williams, mechanical superintendent of the Soo Line, said:

"I think it will be conceded by all who are in charge of freight-car repairs that the maintenance of freight-car equipment on account of weak draft gear is one of the largest items of expense in the repair of cars. I think we have all noticed that the improvement in draft gear has not kept pace with the other improvements of freight-car equipment, such as brake gear, bolsters and framing.

"If we pass through any large freight yard and examine the draw gear of different cars, we find that, practically, a large majority of cars have the same design of draft gear that was applied fifteen years ago on twenty or twenty-five thousand pounds capacity cars. While it is true that parts of the attachment, such as pocket straps, follower plates, draw lugs and springs, are made heavier in order to resist the pulling and buffing, at the same time they are attached to the draft timbers in practically the same manner as was the practice on lighter cars—that is, the draw lugs are bolted, each independently to the draft timbers, which, in itself, is an element of weakness. The continual shocks that the drawbar receives weaken and loosen the bolts, and eventually draft timbers are split and destroyed.

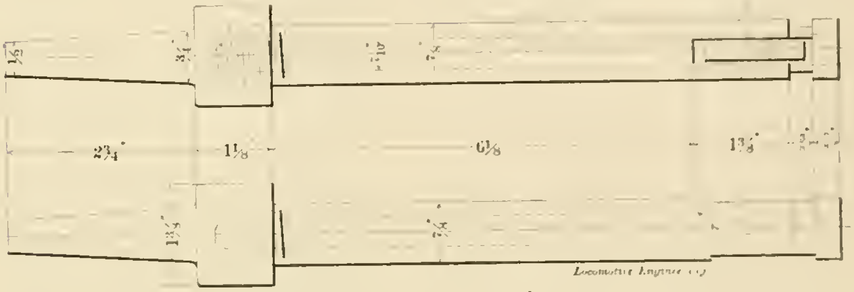
"There are a great many excellent devices, in a number of cases patented, which are an improvement for draft gear. Among others I might mention one where the spring is inclosed in a casing with double projections on each side of the spring pocket, gained into draft timbers, the bolts extending through both draft timbers and spring casing, and bolting the draft timbers and spring casing or box firmly together. I think this is a decided improvement, and an arrangement that will reduce the damage to the draw gear. There are others that I have noticed, such as double springs, and in one case that I have in mind where not only double springs but a double pocket strap is used. This, in my opinion, is a very excellent device, and one that certainly will reduce the cost of repair of draft rigging. Of course, the continuous drawbar is no doubt an improvement over the old style of drawbar rigging, but, from my observation, there is an element of weakness in the continuous bar, i. e., it is liable to stretch, and I think that there has been considerable difficulty experienced in keeping the rods at the proper length.

"On a large number of cars that have recently been built I noticed that the drawbars have been applied directly to the center sills, doing away with draft timbers. Of course, an arrangement of that kind would be impracticable on cars already built for draft timbers, for the reason that it would raise the drawbars too high above top of rail. At the same time, it strikes me that where cars are designed to place the drawbars or couplers between center sills, it is a very excellent arrangement."

A Tool for Broken Staybolts.

The terrors of a staybolt broken behind the frame of an engine, are dissipated by the little tool shown in our engraving. It is made to use from the inside of the firebox after the ordinary drill has done its work, by passing through to the outer hole and gradually enlarging it until the broken bolt is entirely cut away down to the thread. This is done by forcing out the swiveled cutter to any amount wanted, by means of the $\frac{7}{16}$-inch spindle passing through the center of the tool, and which is forced against the inclined face of the cutter's edge by means of the shank shown screwed on the body and bearing against the end of the spindle. Reliance for the fit of the new bolt in the outer sheet is placed entirely on the taper fit, which makes heading-over unnecessary, as it is screwed in from the firebox side, and the fit is assured by the taper alone.

The shank is made to fit the shaft of the "universal tools" illustrated in another column, and this device is easy of manipulation in the firebox or any other place it may be used. The tool was designed under the supervision of Superintendent of Motive Power Turner, of the Buffalo, Rochester & Pittsburgh Railway. Mr. Harry Edwards, the foreman boilermaker at Rochester, informs us that its value cannot be over-estimated in the saving it effects by drilling out a broken staybolt while the main frame of an engine is left undisturbed. The cost for staybolt renewals has been an item of no inconsiderable consequence when the removal of a frame was involved; this tool has reduced it to a reasonable figure.



TOOL FOR CUTTING OUT BROKEN STAYBOLTS.

A flue-cutter has been recently patented by Thomas De Coursey Ruth, of Buffalo, N. Y., which has a very strong resemblance to one that has been used for several years by Mr. Turner, master mechanic of the Buffalo, Rochester & Pittsburgh Railway. The cutter consists of a sectional block with flange on the end, which goes up against the tube plate. Inside there are two cutters which are pushed against the tube by a tapered arbor. The only difference that we can see between it and Mr. Turner's device is that the patented article has two cutters, while Mr. Turner uses one.

The Executive Committee of the New York Railroad Club have decided that the sending of their monthly reports to the members of all other railroad clubs is a source of expense, embarrassing to the club, and they recommended that the practice be stopped. On the question being put before the last regular meeting of the club, it was unanimously voted not to send reports to those who are not members of the club. The Executive Committee have arranged to purchase sufficient copies of other clubs to supply one to each member of the club.

A Fighting Engineman.

Every man who has railroaded for a single day on the Rio Grande has heard of John Jones—"Scrappy" Jones they called him. If there is such a disease as scraptomania, then John Jones had it, good and hard. He began at the bottom as helper in the machine shops, and industriously fought his way up the ladder until he became a full-edged locomotive engineer. There is scarcely a flag station on the entire system that has not been his battlefield.

The most interesting feature in the history of Jones is the fact that he never sought a fight, or fought for the "fun of it," as most fighting characters do. I knew him intimately, worked with him many a day, and it seemed to me that he had fights thrust upon him in nearly every instance. When he was "hostler" at Salida I was his assistant. One day when we were dangling our feet from a high bench in the roundhouse I asked him how it was that he had so many fights. "You are better tempered and happier than I am; I have had one fight since I began railroading; how many have you had?"

" 'Bout a hundred," said Jones, and his homely face was sad. He told me, then and there, that fighting was his besetting sin. He had worked and prayed that he might be spared the necessity of thrashing men, but it seemed a part of his mission on earth. When the noon whistle sounded we slid off the high bench and went into the washroom to prepare for luncheon. Before we left the house we were obliged to use the turntable. "Hey, there, back up. We want to use the turntable!" Jones called cheerfully enough to a passenger engineer who was oiling his locomotive, which, contrary to all rules and customs, was left standing on the turntable. Now, Jones had thrashed nearly every engineer he had fired for during his apprenticeship, and they all hated him, so this middle division man only gave him a sour look and went on oiling. "Say," said Jones, rolling his thumb and twirling his watch chain about it, "are you going to back up?"

"Yes, when I get ready," was the reply. Jones made straight for the engine. As he climbed up on one side, the driver mounted from the other, and, snatching up a hand hammer, raised it above Jones's head and warned him to keep off his engine. I held my breath as Jones continued to climb and the engineer stood ready to brain him. When the hostler, who appeared not to have heard the warning, had gained the deck, he twisted the hammer from the grasp of the engineer, threw it back into the coal tank, backed the engine from the table, set the air brakes, and leaped to the ground. He had missed a fight here simply because the engineer weakened, and yet Jones was wholly in the right.

Once when he was firing a passenger engine they stopped at Cleora, only two miles from the end of the run. The engineer abused Jones and Jones thumped him. The driver told the conductor that he would not run the engine in with that fireman, whereupon Jones gave the driver another licking, drove him into the cab, and compelled him to go to the end of the division. There was an investigation in the office of Master Mechanic Kelker, at Pueblo. The engineer began to abuse the fireman and he was notified by the latter that such a course was liable to lead to trouble. Presently the engineer called Jones a liar, and instantly he fell sprawling across the master mechanic's desk. This caused the fireman's discharge. But the provocation had been great, and the official gave Jones a rather complimentary letter to the general master mechanic at Denver. Jones went up and told the whole story, not even attempting to justify his own actions, and he was reëmployed upon another run.

In those days engineers and firemen worked far apart, and as Jones had licked about half the engineers on the middle division, he was simply despised by the men on the right-hand side. There was a young Irishman who was a magnificent man, physically, and possessed of no end of sand, and to this handsome fellow was given the task of thrashing Scrappy Jones. They met one day out at the steel works and the Irishman had no trouble in working Jones up to the proper pitch. Jones told the story of this fight to me. "He looked like a giant," he said, "when he faced me, but I was mad. Before I knew he was within reach he hit me square between the eyes, and it seemed to me that it was raining fire. I fell sprawling on my back, but got up as quickly as I could, and he knocked me down again. I got up again, with the air full of sparks. He knocked me down again. More fire, I continued to go down and get up. It didn't hurt so very much, only it blinded me, and that annoyed me, for I was anxious to see how he did it, for I had never found it utterly impossible to get at a man before. As often as I straightened up he hit me plumb between the eyes and down I went. I had been down six times, but my wind was better than that of my opponent, and that very fact seemed to discourage him. He was breathing like a snow plough, and when I went down for the seventh time he started to climb my frame, and that was his Waterloo. I saw him coming, dimly, as through a veil all dotted with stars. I doubled up like a jack-knife, and when I straightened my legs out I drove my feet into the stomach of my antagonist. He went over on his back, and I went over on top of him and closed the incident. He had me whipped. I was completely done out, and three more falls would have ended me, but he got scared and wanted to end the fight."

The next man selected to discipline Jones was a yard master, Jim Williams. When Williams saw the fighter for the first time he laughed.

"Are you the artist that has licked all the engineers on the middle division?" asked Jim with a quizzical smile.

Jones showed plainly that he was embarrassed. He always looked so when he knew that a man was trying to pick a quarrel with him. He answered that he had done the best he could for those who had come up against him, and Jim laughed some more. Three or four seconds were now wasted in preliminary talk, and then the two climbed into an empty box car and shut the door. The men on the outside only listened to catch a word that would give them some idea as to how the fight was going, but there was no talk. At times one would fancy that a football team was performing inside. Now there came heaves and grunts as if two men were trying to put up a heavy stove, and then you might guess that a dray had backed up to the opposite door and they were throwing in a few sacks of potatoes. Presently there was a "rush," and they threw in the dray, horse and all. This was followed by perfect quiet, save for the heavy breathing of the horse. A few moments later the door was opened and the two men came out, bleeding through their smiles, and still the result of the fight was a secret, and it has, so far as I know, remained so to this day.

Jones's fights became so notorious that the traveling engineer waited upon him to say that the master mechanic had ordered that the beligerent engineer be discharged at the conclusion of his next fight. Jones promised to reform. About a month later the traveling engineer climbed into the cab of the engine, which Jones was running, helping trains from Colorado Springs up over the Divide. The young driver showed much feeling upon meeting the T. E., and at once assured the official that he appreciated the kindness of the management; that they had all been very forgiving, and now he hoped that he might leave the service with the good wishes of the officials.

"Why, you are not going to quit, are you, John? The old man has complimented you repeatedly upon the excellent work you have been doing here on the hill."

"Then I take it that the old man isn't on," said Jones. "That's like you, Frank, to try to save my neck, but it's no use."

Suddenly it dawned upon the mind of the traveling superintendent of motive power that Jones had been fighting. If he wanted to be sure all he had to do was to ask Jones and he would get the whole truth, so he asked him whom he had fought with.

"The hill crew," was the brief reply.

"All of them."

"Yep—began on the head brakeman and cleaned out the caboose, including the captain," said Jones, with no show of pride. The official jumped off the engine and swung into the caboose of an eastbound freight train, and that was the last Jones heard of the order to discharge him, for the conductor was too proud to report the fact that a little man weighing less than 140 pounds had cleaned out the crew with his naked hands. The story of this fight, and how it came about, was related to the writer by the traveling engineer himself.

"We've got a cranky engineer," the old brakeman had said to the new brakeman who boasted that he was off the stormy division of the "Q" and that he had not yet met an engineer who could tame him. "The only way you can handle him is to go at him dead hard from the jump—cuss him good and plenty, and, if necessary, thump him, and he'll be your friend."

"Cussin's like walkin' to me," said the "Q" man, "and when it comes to a scrap, that's me Prince Albert," and he went up to the head end. When he had arrived at a point immediately under the cab window he began a torrent of blankety blanking that made the engineer dart his head out of the window to see what was the matter. The moment that Jones realized that the fellow was cursing him he leaped right out through the cab window and lit on top of the brakeman, and by the time the rear man came up the head man was yelling for help. He told Jones at once that the rear brakeman had informed him that the engineer was a tough mug, and had to be cursed or he would be ugly, and Jones promptly apologized to the head brakeman and thrashed the other fellow. Now, the conductor, who had allowed all this to come about with his knowledge and silent consent, observed that Jones was a brute, and he got what the other two men had received, and from that day the hill crew dwelt together in peace and brotherly love.

Once when Jones was still a fireman he was transferred to the mountain division, so as to be forgotten for a time by the engineers of the middle of the road. When he reached the top of the hill for the first time he noticed that the rear end of the tank was covered with wet cinders, and, like the industrious fireman that he was, he got up and began to sweep them off in the long snow shed at Marshall Pass.

The superintendent's private car was standing near by, but Jones did not notice it in the smoky shed, and the first swipe of his broom sent a flood of cinders over the superintendent, who happened at that moment to be passing.

"Blank blank you!" shouted the official, and as he looked up he saw the fireman leap from the top of the tank, and he had to step back to avoid a crush. "Do you know who I am?" asked the official.

"No, and I don't care so long as you've got gray hair."

"I'm the superintendent."

"Well, ——— you, don't you ——— me again," said Jones, and he got back on his engine, and the superintendent, who was himself a high-spirited man, remarked afterward that he liked that fellow's spunk, and, in fact, he showed in after years that he did like it, for he would have Jones when none of the other division superintendents would.

The last time I saw Jones he told me that he had quit railroading. He had bought, with the money he had saved up, the old farm in Kentucky, where he was born, had married the little girl who had been his playmate in childhood, and I presume she and I were about the only close friends he had whom he had never thrashed.—*Cy Warman in New York Sun.*

Relation Between Track and Rolling Stock.

A highly valuable paper was read at the December meeting of the New York Railroad Club, by Mr. E. E. Russell Tratman, on "The Relations of Track to Traffic on American and Foreign Railways." The drift of the paper was to the effect that track matters do not receive sufficient consideration from railroad companies, and that the best interest of the companies suffer thereby.

A great deal of valuable information was given concerning the conditions of track, the weight of rails, the fastenings of the same, and the kind and quality of ties used by different companies. It was said that it sometimes happens among American railroads that during seasons of depression the necessary work was not put out upon maintaining the track in proper condition, and that it was a very expensive policy. We consider that one of the worst phases of American railway management has been that whenever a call for reduction of expenses arises, the track is the first to suffer by a reduction of expense and labor. This not only involves much extra expense in getting the track back into safe condition, but it is destructive on the rolling stock that runs over it, and greatly increases the expense of maintenance and repairs.

Although this policy is a great deal too common, the tendency to maintain tracks in good condition is growing, and the authority of the Railroad Commission of New York State is quoted to the effect, that notwithstanding the financial depression, many betterments have lately been added to the main lines, looking to increased safety in transportation. The danger of facing switches is being eliminated as rapidly as possible upon all principal roads. The rule-of-thumb method of adjusting curves has given way to modern, scientific formulas, and the principal roads are placing and keeping curves in better adjustment for speed. Derailing switches are coming into more general use upon spur lines and sidings having a down grade to main track. Many of the single-track roads are making dead ends where feasible on sidings, thereby reducing to minimum the facing-switch evil. The railroads in other States are working slowly in the same line of progress.

Exception was taken to the enormous weight on locomotive drivers, and tables were given showing the weight of driving wheels on locomotives belonging on a few of the principal lines. The greatest weight of wheel is 22,650 pounds, which is carried by the moguls belonging to the Delaware, Susquehanna & Schuylkill Railroad. Some of the other roads are not very far behind these, and the track department insists that the enormous weight is very hard on rails and their connections.

The statement was made that railway engineers are less aggressive in asserting the needs of the track than the superintendents of motive power in asserting the needs of rolling equipment. The financial officers are more disposed to heed the latter, as being more directly and apparently related to the earning capacity of the road. This is no doubt true to a great extent, especially on small lines, and it is a pity that a broader policy is not pursued, for railway managers ought to have an eye to the best interests of the company, which would require that the kind of rolling stock employed should depend on the kind of track and bridges that are going to carry it.

In the discussion that followed the reading of the paper, Dr. P. H. Dudley, the well-known engineering expert, made a statement concerning the advantages that had arisen from the introduction of heavier rails upon the New York Central and Boston & Albany railways. Diagrams were given showing the improved condition of the track that resulted from each addition to the weight of rails.

The practical effect of the improvement has been that locomotives haul more cars with greater ease and there is less wear on running gear. Increase in the size of rail heads has a very decided effect in preventing the wear of tires, and locomotives with 20,000 pounds per driving wheel show less wear on tires on heavy rails than much lighter locomotives did when the rails were lighter. Dr. Dudley made the point, that the better the track, the cheaper and safer was the operating of traffic, which engineers have come to accept as an acknowledged axiom.

A statement was made to the effect that ties now cost more than rails for railroad tracks, which is an additional reason why heavy rails should be employed.

When tool-users purchase tools by weight, it is a wise plan to find out how much each tool actually weighs. We heard of a case lately where a very heavy tool fell 8,000 pounds short of what it was represented to weigh. Smaller tools are liable to the same kind of miscalculation.

Why They Don't Steam.

We know of no subject connected with the operating of trains that excites so much attention among all classes of railroad men as—"What is the matter with locomotives that are hard steamers?" A variety of causes help to bring this undesirable condition about. A few of them are well described in an article contributed by R. MacBain to the "Fireman's Magazine":

Some of the causes why "she don't steam well," he says, may be summed up as follows: Smokestack or exhaust pipe out of "line," front-ends not kept tight enough to exclude atmosphere; tubes not bored out often enough; grate openings not sufficient, on account of openings becoming filled by foreign matter or perhaps not enough when entirely clear; and last, but not least, poor management on the part of enginemen. The smokestack and exhaust nozzle should be in perfect alignment. This is imperative for economy. The exhaust tip should be just large enough to handle the fire to the best advantage and produce the necessary heat units to make the required amount of steam without "forcing" the fire by shaking grates and using slash bar to excess. If more than one grade of coal is used the locomotive should be so adjusted as to meet the demands of each kind to the best possible advantage, i. e., strike the medium. It will be found, on the average extension front locomotive, it is more economical to have the nozzle a little small rather than a little large, particularly on freight engines. I do not mean to advocate a small nozzle, but of the two evils I would choose it, for the reason that it will do the best and most economical work when the coal varies in quality. The front ends should be kept tight (watch the cinder trap) and all other openings that are liable to get out of order and admit air to the detriment of the engine by destroying the "vacuum" in the smokebox. Keep the flues bored out clean. One engine neglected in this way will waste enough coal in a trip to pay for cleaning out a dozen sets of flues. Keep the grate bar openings clear and the clinkers off the crown-bar bolt heads, and the efficiency of the engine will repay for the labor in carrying out the above.

To bring about the best possible results, there must, in addition to the above, be careful, skillful and conscientious effort on the part of engineers and firemen. A great amount of fuel is wasted by some engineers (who are good runners) in starting out of town in neglecting to "cut her back" as the speed increases, or as it should be done. I have ridden with men who complained of their engine not steaming, yet in pulling out of stations (with the latest design of quadrant) they would go about two train lengths at full stroke, then they would hook her up about half way and put their heads out of the window and forget that the fireman was on earth. After having their visit out with the scenery along the way would suddenly look around to find both steam and water low. She would then get the final hook up, accompanied by an inquiring look at the unfortunate on the "wooden end of the shovel." Result, poor time; cause, poor judgment on part of engineers, who are not the last men "set-up" either, except in a very few instances.

In order to do what is just by the employer, an engineer should pay the closest attention to his work at all times and instead of hooking her up by installments of ten or twelve notches at a time he should do so one or two at a time. By so doing the fire can be maintained at something near proper conditon, water can be kept up to the proper level and she will steam better. Besides this the fireman will think you are a nice runner and feel it incumbent upon himself to do the best he can, a thought that will never occur to him if you "visit" in getting out of town. A fireman to be valuable to his employers should have in addition to his muscles a liberal amount of ambition and all the information he can avail himself of in regard to combustion, etc. No very successful or progressive firemen ever develop out of the boy who gets around on short time, and who does the most of his firing "off the seat." In order to get the best results he must attend strictly to his work. Never while running put in more than two shovelfuls at a time, and doing this systematically, always keeping in mind where the last fire was put. Never cover the whole surface of fire in putting on fresh coal; leave a bright spot to ignite the gases from the new coal as they pass toward the flues. By so doing you will soon get the banner as a smoke-preventing fireman, and that is the best possible evidence that you are an economical one. It is safe to estimate that if men in charge of power and engineers and firemen would carry out the above suggestions that a good many thousand dollars a year could be saved to their employers and you would all feel better toward one another.

Citizenship and Technical Education.

We have received from the Lehigh University a copy of an address delivered on Founders' Day, on "Citizenship and Technical Education," by Mr. John H. Converse, A. B., of the Baldwin Locomotive Works, Philadelphia. The address is particularly pointed and interesting, and in a broad way discusses the subject of technical education from a business man's standpoint.

It is too long to be published in our columns in full, and it is one of those products little susceptible to being condensed. Our advice to those interested in practical technical education is to send to the University for the pamphlet. Mr. Converse is not much in sympathy with the practice prevailing in this country which keeps the various States from promoting technical education. In this regard he says: "France has its comprehensive scheme of education, including the primary, the secondary and the superior technical schools. The outgrowth of that era of organization which marked the First Empire has been maintained and developed to the present day. Government supervision and uniformity of methods have made its advantages available to all seekers. Germany goes still further. There the gymnasium leads to the university for literary and general culture, to the 'realschule' for business training, or to the technical schools for the acquirement of the practical professions. Even China, half heathen as we are accustomed to regard 'The Flowery Kingdom,' has its system of competitive examinations under government auspices, promoting the highest culture under the standard there prevailing. Appointments and promotions to civil office are made from the lists of those who have obtained the highest rank in these competitions."

After discussing the advantages and duties of technical education, he concludes: "The education will, it is true, be an effective implement, but its owner will still have to learn its use. The interests of manufacturing and commerce have little respect for the dignity of science. Their motto is that 'Nothing succeeds like success.' The practical man who knows thoroughly a few things is considered superior to the theorist who has a partial knowledge of a variety of subjects. The graduate must, therefore, be ready to subordinate his training to the necessities of the business. He will undoubtedly in good time find ample opportunity to utilize his knowledge. There is one term too commonly used which is mischievous in its influence. We hear of a young man seeking a 'position' in a business. It is not 'position,' but opportunity of usefulness that should be sought. Faithful and intelligent service will generally secure recognition in the long run.

"A young man of my acquaintance, who had completed his course as an electrical engineer, sought employment with the Westinghouse Electrical Company. The first work to which he was assigned consisted in trueing up by hand the plates of an armature and covering it with asbestos, a process which perhaps could have been as well done by an ordinary laborer. The manager grimly remarked that such a job was what they usually assigned to college graduates. The young man accepted the task without a murmur, and in no long time was promoted to more important and congenial duties. Another case within my knowledge is that of a young man who had received his degree as mining engineer. He learned that a certain smelting works in one of the Western States had applied to the president of his institution for some one to serve as a helper in the assay department.

The salary was inconsiderable, but the place was accepted, and within a year he had been promoted by successive steps until he was offered an engagement as manager of the works.

"One more instance will suffice. At the commencement exercises of 1895 of my own Alma Mater, a young man just graduated as mechanical engineer applied to me for employment. It was arranged, and on September 1st he reported for duty and was assigned to work in running a shaping machine in a night gang. Several promotions were secured in a reasonable time, and on May 1st an application, which was received from the Government of the United States of Colombia for a principal instructor in a mechanical school in that country, was filled by the nomination by his employers of the young man referred to."

Thermodynamics.

Among the new sciences which have grown up during the last century in connection with the development of the mechanic arts, that of thermodynamics holds a conspicuous place. We have been asked to define thermodynamics, and to do so we turn to our right-hand mentor, Webster's Unabridged Dictionary, and find that it is "the science which treats of the mechanical action or relation of heat."

When we are further asked what has that science done for the world, we were at a loss for particulars until we remembered something of an address made on the subject by Professor De Volson Wood at the Stevens Institute of Technology. On looking that up, we find the learned professor says of thermodynamics that:

1. It has shown wherein the efficiency of heat engines may be improved by increasing the range of temperature through which the fluid is worked.

2. It determines the efficiency of an engine compared with the calorific power of the fuel. This could not have been done prior to the determination of the mechanical equivalent of heat.

3. It generalizes and systematizes the study of all heat engines—steam and other vapor engines, gas and hot-air engines, compressors, injectors, etc.

4. It has led to the determination of certain properties of saturated vapors.

5. It has led to certain graphical representations which present certain principles more clearly to the mind.

6. By it one may design, thermodynamically, the volume of the cylinder to do a given amount of work, determine the pounds of fuel and the pounds of steam. In practice there are wastes which must be determined practically and allowed for before the thermodynamic engine will be a practical one.

7. It gives a definite solution to certain problems in refrigeration.

8. It has been a means of discovery; as, for instance, by it was made the first correct determination of the specific heat of air; the liquefaction of vapor due to expansion in a non-conducting cylinder; the volume of a pound of vapor; the specific heat of steam and other superheated vapors at constant volume; the heat of vaporization of ammonia; the approximate value of the specific heat of liquid ammonia; the lowering of the melting point of ice due to pressure; and is used in the solution of many problems which might be resolved by other means.

9. It is related to some of the higher and refined problems of physics. What elements seem more unrelated than the mechanical equivalent of heat and the velocity of sound in air—or other gas—and yet they are definitely connected by an algebraic equation—they are so definitely connected that they cannot be separated. Surely there is poetry in science even if it takes a mathematical genius to find it.

10. By a study of heat in all its phases, of which the mechanical theory is one, a student is led the more to appreciate the importance of saving heat and of means for avoiding wastes; and it gives him an advantage, in the management of steam, over one whose chief business it is to bore cylinders and make pistons and connecting rods.

Where He Learned the Science of His Business.

"I knew Brown was a pretty well-posted man on a locomotive; but when he got to talking with the professor, he cracked it off as glib as you please about foot-pounds, indicated horse-power, Mariotte's law, and a whole lot more things I never heard of before.

"Then we went into the chemical room, and the professor showed us how they test water to see what it has got in it that will scale up a boiler. My! what a sight of gas furnaces, glass measures and little copper stew-pans they had, and about a dozen of the students were at work in there. They got some well water from a pump out in the yard and put a pinch of powder like baking soda in it; it got milky right off; then the white stuff settled at the bottom of the glass, which was the stuff that makes the scale and mud. He put some of the powder in the rain water out of their big cistern, and it didn't show a sign of anything in it. He said all soft water was like that, which made it A1 for boilers.

"Well, when we were coming home I says to Brown: 'How did you learn all these things, so you could talk right along with the professor? When I first knew you it was about all you could do to read good and figure a little; you hain't never gone to school any since you began railroading, except the drafting school the master mechanic started and run nights till he had a lot of you young fellows run through the steps, so you could do pretty fair work at it.'

"Brown flushed up a little and said: 'I'll tell you, Father Troy; I am going to school all the time. I get good books; they were all borrowed ones at the start; now we have money enough to buy them and take papers like "Locomotive Engineering" and our "Magazine," beside what I get from the reading room.'

"'Yes,' says I; 'we get the same papers and read them all through, but I don't remember half what is in them.'

"'That is just it,' says Brown; 'you only read to satisfy your curiosity or to pass away the time. You read the "Locomotive Engineering" all through in one afternoon and forget all about it before next Sunday, but it lasts me a whole week and I think about it between times. Articles on mechanical subjects want to be read over carefully and find out just what they mean, and whether it is anything that will do you any good. If it is, it should be all studied out so the information will be stored away where it will do some good.'

"Now, Clint, wasn't that a quiet roast, and from a young man that fired for me, too? But he done it so cool and quiet like I had to take it. Says Brown, 'So many men think they are studying hard, when the subject they are working over produces no more effect on their mind than the dew on a dusty road; it only lasts till the hot sun comes up. You have got to get right down to business, and work hard at it, when you are learning mechanical principles and operations. It is just as you said—when I began railroading it soon was very plain that to get to the front I must keep up to the times. Most of all the young men now have a pretty good common school education, but you need more than that; so I went right to work to get it, and though it looks like a big job to get up above the common level, it is awful easy when you once get started. It is just fun for me now, and more real enjoyment to put in an hour with my books than out with the boys."—*Clinton B. Conger in Fireman's Magazine.*

Railroad Officers Should Keep Out of Politics.

At the beginning of the presidential campaign, we were urged to advocate in our pages sound money principles for the benefit of our railroad readers. We declined to deviate from our rule of discussing merely mechanical problems, and we doubted the wisdom of any railroad paper trying to influence railroad men as to how they should vote.

From what we have known of railroad men in a somewhat lengthened experience, we were disposed to think that, instead of following advice given by technical papers and representatives of official opinion, the men interested would take the opposite course. Facts seem to have warranted the truth of our prediction. While talking recently with one of the chief officers of a Kansas railway about the election, he expressed the opinion that the management had made a mistake in trying to induce the employés to vote for particular candidates. He said that the men nearly all carried McKinley badges and attended the sound money demonstrations; but when voting day came, he was persuaded, from the results, that a majority of them voted the other way.

The following paragraph from a letter of the Kansas correspondent of the "New York Evening Post" appears to corroborate our views:

"For one thing, there was too much railroad in the campaign. When a Republican speaker of note came to the State, he was met by a railroad official in a private car, and the farmers who drove for ten and fifteen miles over the plains in a wagon without a spring or a cover, looked at the luxurious car and its silver and china-laden table just inside the plate-glass doors and shook their heads. When a Republican speaker missed his appointment, he was accommodated with a special car and engine to haul him half across the State. If a Populist missed his appointment, he did not get there at all. The people who saw the special car come in did not think so much of the speaker as did the other crowd of the man who could not come. It would have been better to hold the special trains until later in the day. Too many men were riding on passes and too much work was done with the railroad employés. They got the idea that there was more influence brought to bear on them than on other people, and this was fostered by the cry of "coercion," until they really believed that they were imposed upon. As a result the sound money element did not get more than half of the railroad vote, whereas they confidently expected 75 per cent.

"To get even, the Populists are determined to make their chief business the regulation of railways. There will be passed some of the most radical laws that have ever been on the statute book, the session laws will read like a dream-book, and poor Kansas will be a laughing-stock again."

Not Equal to Test Results.

When mechanical engineers and others go out to make tests of improved appliances for locomotives, they are very often disappointed to find that the performance which they recorded is very rarely equaled in the practical working of the engines.

A well-known master mechanic, who understood human nature, and had taken part in hundreds of tests of locomotive appliances, used to say, that if you painted the stack of a locomotive red and made tests to find out the effect of the change, a saving of 10 per cent. would be certain to follow. While the test is on, the enginemen are on their mettle to do their best, and so an apparent saving is found; but when they drop back into their easy-going, everyday practice, the 10 per cent. disappears.

Mr. Amman, in a paper read at the Northwestern Railroad Club, related some particulars of a test which appear to sustain this theory of how apparent savings are effected. He said: "A series of tests were made; several varieties of coal were tested, and very satisfactory results were obtained from a certain grade of Eastern coal. The engine was one of the standard type used on that portion of the road, and was in ordinary condition. The records showed that 55 miles per ton were made by the engine with the coal referred to, and as a result it was adopted as the fuel to be used. When making the test, no coal was charged to the engine other than that actually used in hauling the train from one terminal to the other, and as the trains were composed of through freight, no delays occurred; but when the same engine and crew were put into ordinary service, and received coal in the same manner as it was delivered to other engines, the best mileage that could be obtained was from 25 to 28 miles per ton, or about 50 per cent. of a falling off."

This, he says, was undoubtedly due to the improper methods of accounts. We are inclined to think that it was due partly to the tendency that nearly all experts have to favor the machine they are testing, and the tendency that enginemen have to do their very best when they know that the eyes of experts and master mechanics are upon them.

Too Much Counterbalance.

It is a mistake to imagine that because a locomotive is counterbalanced to run smoothly that she is in a condition to do no damage to the track. There are many master mechanics who appear to think that adding counterweights, until the engine runs without any horizontal or oscillating action, is all that is necessary to make the counterbalances satisfactory. We have never known of an engine that did damage to track which did not ride fairly well.

A Western master mechanic got a very good object lesson some time ago on counterbalancing which others may benefit by reading. There was a certain locomotive on the road that the roadmaster blamed for bending rails when she was running at high speed. The superintendent took up the matter with the master mechanic, and the latter declared that the engine was the best balanced engine on the road. To prove the position taken, he offered to take the engine out a few miles to the top of a steep grade and run her down at high velocity to let the superintendent feel for himself how finely the engine rode, and consequently how well counterbalanced she must be. The trial was made; they went up to the top of the grade and started down and attained a speed of 72 miles an hour. The thing seemed highly satisfactory. They had got the engine back to the roundhouse, and superintendent, master mechanic and engineer were talking among themselves about the cranky roadmaster, when section foreman Tim Sullivan, with his gang, came pumping up on the hand-car. He scarcely got within shouting distance when he called out to the engineer: "Ah! Phil Brown, ye blackguard, ye've raised hell with five miles of my track." Sure enough, for nearly that distance the greater part of the rails were more or less bent by the engine that was considered properly counterbalanced.

Meeting of Mechanical Engineers.

The seventeenth annual meeting of the American Society of Mechanical Engineers was held at the rooms of the society in New York City in the first week of last month. The proceedings opened with the retiring address of President Fritz, who spoke on "The Progress of the Manufacture of Iron and Steel, and the Relations of the Engineer to It." The address was, to a great extent, historical, and gave many reminiscences of the progress of the iron and steel industries in this country.

At the conclusion, the address of President Fritz was discussed by Messrs. Andrew Carnegie, A. H. Jacques, Robert W. Hunt, Robert Forsyth, S. F. Wellman and Allen Stirling. The remarks made consisted mostly of expressions of appreciation of the great services which Mr. Fritz had performed towards the metallurgical interests of this century.

The convention occupied over three days, during which time a variety of valuable engineering papers were submitted and discussed. Abstracts of these are likely to be of interest to our readers and will be published from time to time.

"The hard times we are now emerging from," says Master Mechanic Sanborn, "have compelled us to study economical methods more energetically and persistently than before. We have delved into scrap piles and resurrected material. We have invented methods for harnessing new and old forces to labor for us and work it into equipment. We have squeezed the old oil out of discarded packing to lubricate our machines. We have shut down on supplies for cleaning and running them, and one company, it is stated, even refuse to issue new brooms to firemen until they have cut strings on old ones and worn them down till handles are bald-headed; but we have not materially reduced the largest item of expense in the entire cost of operation—that is the coal account."

The Apprentice System.

For years there have been numerous public speakers interested in the promotion of industrial schools, who have been preaching to the people of this country that the apprentice system is defunct, and urging that the trades schools are the proper places to learn a trade. The primary object in making these assertions appears to have been to excite charitable behests in favor of industrial schools.

The preaching on this text was carried on so persistently that a great many people believe that apprenticeship is a thing of the past, and that the industrial establishments of the country have now to depend upon trade schools and technical institutes for the training of mechanics. The public press, as a rule, believed what the advocates of trade schools said about apprenticeship, and these representatives of public opinion take the tone that apprenticeship has gone forever, and that it is good for the community at large that it no longer exists.

We have repeatedly said that the parties who represented the apprentice system to be dead were either mistaken or were making deliberate misrepresentations, but we were not able to enter into the question very systematically. We are glad to learn, however, that our contemporary, the "American Machinist," has made a thorough investigation of the subject, and has devoted almost the entire issue of December 24th to letters and articles on the subject. The editor of that journal sent out 200 letters to leading machine shops and other establishments where they were likely to employ apprentices; and 116 letters were received in reply. Among those applied to for information were the principal railroad and locomotive building establishments. Replies were received from 25 of the principal railroad companies and locomotive builders, and nearly all those that answered favored the apprenticeship system and employ all the apprentices they can use conveniently. Several of the railroad companies employ apprentices more from a sense of public duty than in the expectation of obtaining profit from the work done by the boys.

We regret that want of space prevents us from printing the letters from railroad men. We recommend those interested in the subject to send for the paper.

A remarkably handsome, illustrated general catalog has been published by the Buffalo Forge Company, Buffalo, N. Y. It is a book of 400 pages, 7½ x 9 inches, profusely illustrated and got up in the highest style of the printer's art. It illustrates the whole of the immense product of the Buffalo Forge Company, and gives numerous illustrations of places where the hot-air system of heating has been applied. Among the subjects dealt with and illustrated are: Horizontal and upright steam engines; mechanical draft fans and apparatus; steel-plate steam and pulley fans; fan system of heating, ventilating and drying; disk ventilating fans; blowers and exhausters; manual-training school outfits; hand and power blacksmith drills; punch, shear and bar cutters; tire upsetters, blacksmith tools, etc.; blacksmith hand blowers; stationary, portable and heating forges. The Buffalo Forge Company will send the catalog on application to any parties interested in the purchase of the goods which they manufacture.

Some train robbers, who held up a train on the Chicago & Alton Railroad, near Independence, Mo., towards the end of last month, improved on the methods of former train robbers. The usual plan is to stop the train for a brief period, terrorize the passengers, and rob the express car as quickly as possible. In the latest case they cut off the engine, baggage and express cars, and ran away with them. They were then able to select the place where pillaging the express car could be done most conveniently and safely. As the attack was made at night, and only a few telegraph operators were at stations, they could go where they wanted without danger of molestation.

Nearly everybody connected with locomotive operating has occasion at times to figure out the tractive power of engines having certain proportions. Some men are working out that problem daily at the cost of tedious calculations. We have got out a sort of circular slide rule which is a graphic computer by which any man, who can read figures, can find out the tractive power of a locomotive in a few seconds. He can also find out in almost as little time the effect of changing such proportions as diameter of drivers, size of cylinders and boiler pressure. It is the handiest device produced for the benefit of busy men in many years. It costs only one dollar.

The National Association of Manufacturers will hold a convention in Philadelphia, commencing on January 26th. It is expected that this convention will be one of great interest, as the president will submit a report of the first full year of practical work. The purpose of the association is to promote American manufacturing interests, and to help in securing foreign markets for our manufactures.

The popularity of the work done by the Association of Railroad Air-Brake Men may be inferred from the fact that they have sold over seven thousand copies of their last annual report. The report is in demand because it contains information about brake matters that all intelligent trainmen desire to read and study.

No Change in New York Central Management.

The "New York World," which is famous for publishing news of events that never happened or never will happen, recently announced a coming change of control and management of the New York Central. It announced that President Depew was going to resign and become Ambassador to the Court of England, and that Mr. Samuel Spencer was going to take his place. Mr. Spencer is representative of the Drexel-Morgan interests, which were reported to have a controlling interest in the New York Central stock, and that an entire change of policy would be the result.

The "World's" story is without any foundation, for Mr. Depew has not been offered the position of Ambassador and has no thought of giving up railroad life. Mr. Depew was interviewed concerning the "World's" story, and he said:

"The Vanderbilts have not had a controlling interest in New York Central stock since 1880, when William H. Vanderbilt sold $30,000,000 in stock to English buyers represented by the Morgan house. Mr. W. H. Vanderbilt thought that the ownership of a majority of the shares of the company by one person or family would be to the detriment of the property. Though the public used and profited by the railroad, it would be more likely to complain of one than of many owners. It was deemed advisable to diffuse the ownership among many persons, and there are now 13,000 stockholders, persons of every condition of life, of course, and the usual number of widows and orphans. To return to Mr. Morgan: He came into the board with Cyrus Field, whom he nominated in 1880, when the English sale of shares was made. Mr. Morgan's house continues to represent the English shareholders. His advice in the management has been invaluable. He is a great upholder of credit, and his relations with other roads and with the banking world make his counsel, as I said, invaluable, just as the Vanderbilts are invaluable with their knowledge of railroad management. Mr. Morgan's relations with the Vanderbilts and with the company are up to this minute precisely what they have been for a long time, and the cordial co-operation will continue to exist. Since the sale of the $30,000,000 to English investors, the capital stock of the company has been increased from $89,000,000 to $100,000,000. The English have not increased proportionately."

The Watson & Stillman people, of New York, made very exhaustive tests some time ago of the strength of Mannesmann tubes, that are used a great deal as reservoirs for compressed air. They found that up to 4,500 pounds pressure to the square inch there was no distortion of the tubes. It took over 6,000 pounds pressure to burst them.

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Misplaced Affection for Scrap.

In our peregrinations among railroad shops, we notice that the hard times, which have brought the scrap heap to the front as supply resort for repair material, have had a demoralizing effect which it will take years to counteract. The pernicious habit of laying aside old worn material, in the expectation that it can be used in the repairs of some engine or car, has attained painful proportions. Railroad companies have gone through the same experience time after time, but the same practices seem always to be repeated when there is difficulty in obtaining supplies from the storehouse.

An engine comes in and gets a new set of axle boxes; two of the old ones are found to be in pretty fair condition, and they are laid away carefully under a vise-bench to be handy for some other engine of the same class that may come in with a broken box. They are not refitted or thoroughly repaired and put into the storehouse where they would be available, but stored away to be forgotten. The men in charge are so solicitous to have something ready for use, without making requisition upon the store department, that the vise benches and other dark recesses are lumbered up with eccentric straps very little out of round, feed pipes that might be used again under extraordinary circumstances, half-worn piston rings, imperfect cylinder heads, a few oil-box cellars, a twisted link hanger, a worn-out rocker box, and a variety of other articles that ought to have been passed through the cupola or forge months ago. A systematic foreman might use some of these things if he would put them in shape for application to the engine before they are stored away; but this is seldom done. and the articles kept to be handy for repairs are never ready when wanted.

Some months ago we visited a large machine-tool-making establishment, and were surprised to find a multitude of patterns, that seemed in good condition, broken up and being used for firewood. This came to us like a startling revelation; for, as far as our knowledge went, it was something unprecendented in the annals of railways. New patterns had been made for improved forms of the machines, and the company considered it the proper policy to destroy the old ones. We had often seen new patterns made to take the place of old ones in railway shops, but we had never heard of the old patterns being destroyed. They are always stored somewhere, to be handy when a demand comes for the article they can reproduce. As a rule, the demand never comes; but the patterns are left there to confuse the men in charge, and to take up room that ought to be utilized for other purposes.

The predilection for preventing the scrap heap from receiving its honest due is not confined to small pieces of rolling stock, and the tendency to take room that ought to be occupied by more useful articles is not confined to obsolete patterns. After years of soliciting, the master mechanic has succeeded in getting a new planer for one that had toiled in decrepitude, long after exactitude and usefulness had become strangers to its operations. The new planer is placed on the foundation occupied by the old one, and it might be supposed that the worn-out tool was consigned to the scrap heap. That is not the prevailing practice, however. It is moved to the corner of the shop, for the purpose of being used for odd jobs. It is continually in the way, and the work done on it needs so much hand-finishing that the jobs cost double what they are worth.

A worse policy than that of crowding up the floor with the old planer is moving a worn-out lathe into another corner and converting it into a bolt cutter. In this new capacity it is a failure from the start, and soon wastes more money in doing poor work, and little of it, than what it would cost to buy a machine designed for the purpose it is doing so badly. Manufacturing concerns that have to look closely to the cost of production cannot afford to follow a policy of this kind, yet intelligent railroad men pursue it and think they are saving money for the companies that employ them. It seems to need special training to make railroad men understand that the scrap heap is the best place for a worn-out article. We commend the work of advocating this sound principle to the railway clubs and other advocates of sound engineering opinion. A few papers and discussions on the evils of scrap-hoarding would do much good at this time.

The Metric versus the Duodecimal System.

A very important contribution to the literature of the metric system of weights and measures has recently been made in a paper contributed to the American Society of Mechanical Engineers, by Mr. George W. Colles, entitled "The Metric versus the Duodecimal System."

The author gives some very interesting historical data about different methods of weights and measures, and makes a very strong plea on behalf of the English system as being not only more convenient, but based on a better philosophical foundation than the French metric system. The confusion caused in France and other countries by the introduction of the metric system is graphically described, and it is shown that the system originated and was forced into use by theorists who knew nothing about the inconvenience to trade that would result, or about the injustice inflicted upon the people through the action of rogues who cheated the buyers who were slow to learn particulars of the new system. The influence of savants, backed by the power of senators, emperors and kings, made very slow progress in forcing the new metrology upon an unwilling people, and several times insurrections against the new system stopped its progress for a time, or led to modifications which made confusion worse confounded.

In 1812, after more than eighteen years of compulsion, and at a moment when a widely popular measure was required of him, the Emperor Napoleon issued a decree completely abandoning, except for a few special cases, the decimal principle, and restoring once more to the people the foot, the ell, the toise, the pound and boisseau, and all their customary subdivisions. This enactment was called the "Systeme Usuel"; but it was far from being the usual system, for the measures to which these terms were now applied were not the old measures, but near approaches to them only, in terms of the metrical unit. Thus the toise was not the old toise, but 2 meters; the foot was not the old foot, but ⅓ meter; the ell was 12 decimeters; the boisseau ⅛ hectolitre, and so on. The effects of this unfortunate new attempt to relieve the commercial distress of the nation may well be imagined; for besides giving to it, as to its units, names which neither it nor they could justly lay claim to, it merely added a new mode of measurement to the already existing diversity, instead of driving them out. The country then had really four different systems of weights and measures, differing in many particulars from each other. There ensued, under this condition of affairs, twenty-five years of inextricable chaos and countless frauds. The small dealers in groceries and liquors, the market men and trades-people generally, cheated without restraint, under the protection of confused laws. When the true metric system was finally restored, it took many years to familiarize the people with the standard system, and no end of injustice and annoyance resulted; shrewd tradesmen, familiar with the system, using their knowledge to defraud ignorant customers.

When conditions of this character were encountered in making and changing the weights and measures in a country where there were few manufacturing or mechanical industries, it may readily be imagined how stupendous the difficulties would be in changing the weights and measures of countries like Great Britain and America. The friends of the metric system have been laboring strenuously for thirty years to force their hobby upon the whole English-speaking people, and it seems probable that Great Britain or America will have laws passed, making the metric system compulsory. Should that be done, the people will awake to realize the inconvenience that must result from such a radical change, and the indignant protest of the whole nation will soon make an end of the attempts to change the system of weights and measures, which is much better than the substitutes offered. Railroad companies have done more than any one interest to establish the use of interchangeable standards, and they would be the leading sufferers from any change which interfered with their established sizes. There is, however, very small danger of their being forced to make an active fight against the proposed change.

Bessemer's Great Work.

Next to the invention of the locomotive itself, the Bessemer process of steel-making has had the most stupendous influence upon the world, and upon the condition of mankind in countries remote from each other. The locomotive led the way to the giving of convenient means of transportation to every region of the globe that could produce anything worth carrying away. The Bessemer process made the steel arteries of commerce so strong and durable, that it is cheaper to move a ton a thousand miles on a railway than twenty miles over an ordinary road. The effect of this invention has been practically to abridge distance, and to bring products, raised thousands of miles away from a market, into active competition with those raised at the doors of the consumers. But for the Bessemer process, or some other method of steel production, the wheat fields of the Great Northwest, and of other remote wheat-raising districts of the world, would yet remain in the condition of grazing lands, and the competition from over-production, which has brought cheap food to manufacturing communities and ruin to many farming interests, could not have taken place. Steel rails made it possible to run a driving wheel with 20,000 pounds of weight upon it without destructive results to the permanent way. The great locomotives with immense weight on their drivers have steadily decreased the expense of moving freight, until it is now asserted that there is profit in moving a ton of freight at 3 mills per mile.

These wonderful effects, resulting from one invention, make the world interested in learning all the facts connected with the working-out of an invention of such great importance. It was natural, then, that great interest should be manifested in a paper recently prepared by Sir Henry Bessemer on a historical and technical sketch of the origin of the Bessemer process, for the American Society of Mechanical Engineers. The paper is doubly valuable historically on acount of the age of the author, who has reached his ninetieth year, and is not likely to contribute any more facts about his great invention. The experiments which led to the invention of the Bessemer process were commenced about 1855, their purpose being to improve cast iron by the fusion of wrought-iron scrap in a pig-iron bath. There was an urgent demand for the stronger quality of cast iron for ordnance purposes, and Mr. Bessemer proceeded systematically to attempt the production of the article required. He carried on a great variety of experiments in open-hearth furnaces without producing what he desired; but incidentally he discovered that air, when blown through a mass of molten cast iron, had the effect of decarburizing the iron. This is the principle on which the successful operation of the Bessemer furnace is founded.

In the course of his experiments, Mr. Bessemer came "within measurable distance," as he calls it, of discovering the method of making steel in an open-hearth reverberatory furnace. Where he fell short was in the absence of a regenerative furnace to maintain the high temperature of the air blast.

It might be well to mention for that portion of our readers not well acquainted with metallurgical operations, that the principal difference between pig iron and steel is that the cast iron contains a large proportion of impurities in the form of silicon, carbon and other hardeners, which were formerly eliminated by the laborious process of puddling.

The importance of Bessemer's discovery will then be understood when he perceived that it was possible to blow out the impurities from the crude metal without any fuel, by merely passing through the mass a current of atmospheric air. Towards the developing of this process he then devoted all his ingenuity, chemical knowledge and energy. A host of difficulties had to be overcome, but they were surmounted step by step until the process became an assured success.

In the Bessemer process, the molten cast iron is taken from the smelting furnace and run in the liquid state into a converting vessel, which is a pear-shaped furnace, lined with firebrick or with some other highly refractory material. The converter is suspended on trunnions, so as to admit of its being turned from an upright to a horizontal position, by means of apparatus provided for the purpose. In the bottom there are a variety of air holes, through which the atmospheric air is driven with a pressure of about twenty pounds per square inch. The molten iron in the converter is resting from the first on a bed of air, the strength of the blast being sufficient to keep it from falling through the tuyeres into the blast way.

In the first part of the blow, the silicon burns out with a steady hot flame; then the oxygen attacks the carbon with an ever-increasing stream of sparks and a voluminous white flame, followed by a succession of mild explosions, throwing the molten slag and splashes of metal into the air—the apparatus becoming a miniature volcano in a state of eruption. At this point, it is known that the silicon and carbon are almost entirely eliminated from the molten mass.

To make a useful metal, it has to be recarburized. This is done by throwing into the converter a charge of ferro-manganese or spiegeleisen—metals that contain a known quantity of carbon and manganese. The blast is again turned on to stir up the mixture, and then the steel is ready for pouring. The recharging of the converter with spiegeleisen, for the purpose of supplying the necessary carbon, was proposed by Mr. Mushet, the well-known steel maker; but in his patent for the process, taken out a year or two before, Mr. Bessemer described how the state of carburization of the converted metal might be regulated by the addition of molten pig iron after the blow had taken place, and in another patent, taken out before one was applied for by Mr. Mushet, he proposed to alloy his steel with any metals previously used to alloy cast steel, and various ways were shown how this could be done. As manganese was one of the metals used for that purpose, it is evident that Mr. Bessemer did not require any help in devising compounds for recarburating his steel.

When Sir Henry Bessemer's paper was read at the meeting of the American Society of Mechanical Engineers, a somewhat heated discussion arose, in which several members hotly contested the claims that the author made for being the inventor of his own process. We do not believe that any great invention has ever been developed where the inventor was allowed the full credit for what he had done. There is always some party who sets up claims for having thought of the same invention and of having worked at it before the successful man got out his patent. Whatever annoyance Sir Henry Bessemer may be subjected to by parties trying to divert the ownership of his work to others, it will have very little effect with the world at large. No man ever succeeded in making steel direct until Bessemer showed the way. The process was complex, and he may have got suggestions from others; but he was the man with the genius to grasp the entire requirements of the case, and it is very ungenerous to try and detract from the merit of his great achievement.

The number of workmen out of employment during the last three years is not surprising when the depressed condition of railway business is taken into consideration. During the years 1890 to 1892, the average increase in the locomotives in the country was over 1,200. During the year ending with June, 1895, the increase of locomotives was only 207, and the succeeding year was still less, although the exact figures are not yet computed. The decrease in the number of cars added to the rolling stock equipment was even on a greater ratio. The decrease in the number of cars and locomotives built during 1894-5 represented a whole army of men thrown out of employment. To add to this army, there were nearly one hundred thousand less persons employed last year than there were in 1893.

BOOK REVIEWS.

"Combustion and Smoke Prevention on Locomotives." By Angus Sinclair. Press of "Locomotive Engineering," 256 Broadway, New York.

This is a small book, 3½ x 6, of 43 pages, made convenient for the pocket. It has been written especially for the benefit of enginemen, but other people who are interested in combustion problems will find it interesting and edifying reading. The scientific problems relating to combustion are treated in a very simple and elementary fashion, the chemical nomenclature being made as simple as possible. It contains explanations of the chemical processes involved in the action of combustion, written in a fashion that any man, who can read, will readily understand. The method of measuring heat by units is explained; also the methods of measuring power processes by foot-pounds; and the mechanical equivalent of heat is made plain. Several pages are devoted to explaining how things burn, what are practical fuels, qualities of coal, and whence the potential energy of the coal arises. The elements that perform their various functions in the act of combustion are mentioned, and the nature of atmospheric air described. The importance of keeping the fire up to the igniting temperature is dwelt upon at some length, and causes mentioned which may reduce this temperature locally in a firebox with a resulting loss of heat. Some of the subheadings of the pamphlet may be mentioned and will give an idea of the scope of the treatise, as, for instance—How a Fire Burns; Distilling Gases from the Fuel; Burning Hydrogen Compounds; Burning the Solid Carbon; Applying the Principles of Combustion to a Firebox; Heat Value of the Proper Admixture of Air; and Velocity of Fire Gases. About half of the book is devoted to the work of firing, from the standpoint of a practical fireman. It is sold by the pub'ishers for 25 cents a copy; $15 per hundred.

PERSONAL.

Mr. T. J. Anderson has been appointed roundhouse foreman of the Illinois Central at Burnside, Ill.

Mr. J. K. Andrews has been appointed chief clerk to Receiver Murray, of the Baltimore & Ohio, at Baltimore, Md.

Mr. Robert T. Baker has been appointed general superintendent of the Morristown & Cumberland Gap. Office, Morristown, Tenn.

Mr. G. W. Russell has been appointed master mechanic of the New York, Philadelphia & Norfolk, with headquarters at Cape Charles, Va.

Mr. Benj. Wooster has been appointed master mechanic of the Cartagena-Magdalena Railway, with headquarters at Cartagena, Colombia, S. A.

Mr. R. S. McVeigh has been appointed traveling agent of the coal traffic department of the Baltimore & Ohio Southwestern at Cincinnati, O.

Mr. J. P. Rogers has been appointed acting superintendent of the Kalispell division of the Great Northern, with headquarters at Kalispell, Mont.

Mr. M. A. Miller has been appointed chief train dispatcher of the Rochester division of the Western New York & Pennsylvania at Olean, N. Y.

Mr. C. C. McNeil has been appointed general superintendent of the Maricopa & Phœnix and Salt River Valley roads, with headquarters at Phœnix, Ariz.

Mr. George P. Haskell, a passenger conductor on the Lima Northern, has been appointed assistant superintendent, with headquarters at Lima.

Mr. R. H. Sanborn has been appointed assistant superintendent of the Dakota division of the Chicago & Northwestern, with headquarters at Huron, S. D.

Mr. J. D. Wright has been appointed general foreman of painters at the Mt. Clare shops of the Baltimore & Ohio, in place of Mr. E. L. Bigelow, resigned.

Mr. M. D. Schaff has been appointed trainmaster of the Cincinnati division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Springfield, Ill.

Mr. E. H. Bankard has been appointed purchasing agent of the Baltimore & Ohio, with headquarters at Baltimore, Md. He was formerly secretary to Receiver Murray.

Mr. T. F. Barton has been appointed general foreman of the Illinois Central shops at Weldon, Chicago, Ill. He was formerly roundhouse foreman at Burnside, Ill.

Mr. Frank Barr has been promoted from division superintendent of the Boston & Maine to be assistant general manager of the road, with headquarters at Boston, Mass.

Mr. W. B. McCaleb, superintendent of the Bedford division of the Pennsylvania Railroad, has been appointed superintendent of the Sunbury division, with office at Sunbury, Pa.

Mr. H. F. Houghton has been appointed assistant superintendent of the Chicago division of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Indianapolis, Ind.

Mr. A. N. Gray, chief clerk to Second Vice-President Newman, of the Great Northern, has been appointed chief clerk to General Traffic Manager Clarke, of that road, at St. Paul, Minn.

Mr. R. H. Bowron has been appointed superintendent of the Montana division of the Great Northern, with headquarters at Kalispell, Mont. He was formerly train master of the Montana Central.

Mr. C. E. Lee, heretofore train dispatcher, has been appointed superintendent of the Worcester, Nashua & Portland division of the Boston & Maine, with headquarters at Nashua, N. H.

Mr. R. C. Westcott has been appointed division superintendent of the Minneapolis & St. Louis. He was formerly assistant superintendent of the Minnesota division of the Northern Pacific at St. Paul.

Mr. R. G. Mathews, formerly general superintendent of the Buffalo, Rochester & Pittsburgh, has accepted the position of general sales manager of the Mozier Safety Signal Company, of Cleveland, O.

Mr. William Quinn, trainmaster of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed superintendent of the same division, with headquarters at Mt. Carmel, Ill.

Mr. H. A. Wilson has been appointed advertising agent of the Toledo & Ohio Central, with headquarters at Toledo, O. He was formerly district passenger agent of the Columbus, Hocking Valley & Toledo.

Mr. E. Youngman has been appointed chief clerk of the advertising department of the Pennsylvania, *vice* Mr. D. N. Bell, who has gone to New England as general agent of the company in the passenger department.

Mr. W. G. Bayley, superintendent of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, has been appointed superintendent of the St. Louis division of that road, with headquarters at Mattoon, Ill.

Mr. W. C. Shoemaker, who has been chief clerk to Superintendent S. B. Floeter at Lima, has been appointed assistant superintendent of the Dayton & Michigan division of the Cincinnati, Hamilton & Dayton road.

Mr. E. M. Neel, superintendent of the St. Louis division of the Cleveland, Cin-

BRAINS and GRAPHITE.

A celebrated painter, on being asked how he mixed his colors, said he mixed them with brains. Brains were quite as necessary as the finest and most durable colors. It has been the brains that locomotive engineers have mixed with Dixon's Pure Flake Graphite that have produced such splendid results in graphite lubrication during the past year.

Many roads have now adopted the use of Dixon's Pure Flake Graphite and are better equipped for having done so, as the trials made by expert and intelligent engineers have demonstrated the value of this graphite beyond any question.

An instance of the good sense and skill of the engineer, and care of his locomotive, is shown in the following letter from an engineer on the P. R. R.:

"On August 25th, while on my way to Toms River, the left back engine-truck box became hot, but having a fast train, I was some time in locating it; then, by the liberal use of oil and water, finished my trip with only about ten minutes' detention.

"Finding the box and journal very hot, I decided to repack it the next morning. In the morning I went to my engine about an hour earlier than usual, took the cellar down, cleaned it and found the metal entirely gone from the box, the crown bearing only remaining.

"I packed the cellar with new waste, and that part next to journal I supplied quite plentifully with Dixon's Flake Graphite; but even then I expected trouble.

"I left Toms River with train known as 'Long Branch Limited.' After running about fifteen miles, I examined the box and found it with simply the chill off, and on reaching Long Branch found it but little warmer after running eighteen miles more.

"At this time we were six minutes late, caused by waiting for connection. Our time from Long Branch to Jersey City, a distance of fifty miles, is one hour and seven minutes. Deducting the six minutes delayed, left me only one hour and one minute; but having confidence by this time that no trouble would come, I concluded I would make up the six minutes, and I am extremely pleased to say I reached Jersey City on time, making the fifty miles in sixty-one minutes, with two stops—Elizabeth and Newark. At no time was the box warm enough to smoke, and I know of no more severe test of the cooling and lubricating properties of Dixon's Pure Flake Graphite."

If the right kind of graphite is used, and used properly, it will relieve the engineer from many worriments, reduce the number of train detentions, and prove a source of great economy to the railroad companies.

cinnati, Chicago & St. Louis, has been appointed assistant to General Superintendent Van Winkle, of that road, with headquarters at Indianapolis, Ind.

Mr. A. D. Peck has accepted the position of chief train dispatcher of the Florida Central & Peninsular, with headquarters at Savannah, Ga. He was formerly train dispatcher of the Rochester division of the Western New York & Pennsylvania.

Mr. J. D. Finn has been appointed superintendent of the Lake Superior Terminal & Transfer Railway, with headquarters at Superior, Wis. He was formerly superintendent of the Montana division of the Northern Pacific at Livingston, Mont.

Mr. Edward Sauvage, chief mechanical engineer of the Western Railway of France, is author of a well-known book on Locomotive Engines, and a new work from his pen, on the Steam Engine, has just been published by a Paris publishing house.

Mr. W. C. Dotterer, of Little Rock, Ark., has been appointed general manager of the New Orleans & Western, with headquarters at New Orleans, La. Mr. Dotterer has been manager of the Union Compress Company, of Little Rock, since August, 1889.

Mr. F. P. Abercrombie, assistant engineer of the Eastern division of the Philadelphia & Erie and the Susquehanna division of the Northern Central, has been appointed superintendent of the Bedford division of the Pennsylvania Railroad, with headquarters at Bedford, Pa.

Our readers will be pleased to learn that Mr. Spencer Miller, engineer of the cableway department of the Lidgerwood Manufacturing Company, New York City, is again at his desk after an absence of very nearly four months. Mr. Miller was taken with appendicitis early in the summer, and has but recently recovered from the operation necessary.

Mr. Gerrit Fort, for the last five or six years chief clerk of the general passenger department of the New York Central, has been appointed secretary of the Central Passenger Committee at Chicago. Mr. Fort was formerly in the general offices of the Burlington, Cedar Rapids & Northern at Cedar Rapids, and learned the first part of the business there.

Mr. J. D. Hawks has been elected president of the Detroit & Mackinac. He has hitherto been vice-president and general manager and he will continue to perform these duties. His headquarters will be in Detroit. Mr. Hawks is one of the most accomplished civil engineers in the country, and was for eight or ten years chief engineer of the Michigan Central.

Mr. A. J. Davidson has been appointed superintendent of transportation of the St. Louis & San Francisco, with headquarters at St. Louis, Mo. He was formerly superintendent of the Northern division of the Gulf, Colorado & Santa Fé, and was presented with a handsome silver service by his friends and associates at Ft. Worth, Tex., when he left the road.

Mr. O. W. Beckwith, who was recently appointed trainmaster of the Cincinnati division of the Cleveland, Cincinnati, Chicago & St. Louis, at Springfield, O., has been transferred to Kankakee, Ill., as trainmaster of the west end of the Chicago division. Mr. Thomas Reynolds has been appointed trainmaster of the east end of the Chicago division, with headquarters at Cincinnati.

Mr. C. L. Mayne, division superintendent of the Fitchburg Railroad at Fitchburg, Mass., has been appointed assistant general superintendent of that road, with headquarters at Boston. Mr. Mayne was formerly 7½ years connected with the Chicago & Atlantic as chief train dispatcher, trainmaster and superintendent, and went to the Fitchburg as division superintendent in January, 1892.

Mr. A. E. Reed, superintendent of the Sunbury division of the Pennsylvania Railroad, has been appointed superintendent of the Altoona division, with headquarters at Altoona, Pa., to succeed Mr. Robert T. Marshall, deceased. Mr. Reed has risen through the track and engineering department, and at one time attained considerable celebrity in connection with original designs of engine houses.

Mr. A. J. Cabe has been promoted from assistant superintendent to be superintendent of the Butte, Anaconda & Pacific, with headquarters at Anaconda, Mont. Mr. Cabe was for five years superintendent of the Dakota division of the Northern Pacific, and for some time superintendent of the Kalispell division of the Great Northern. Of late he has been assistant superintendent of the Butte, Anaconda & Pacific.

Mr. J. S. Lane, formerly of Webster, Camp & Lane, Akron, O., and later of M. C. Bullock Company, Chicago, has just returned from a professional engineering trip to England, and to the gold fields of the Transvaal in South Africa. He reports things as very active in the African gold fields, a large number of Americans and Englishmen with capital having located there. Mr. Lane is with his family in Connecticut, and will shortly return to London.

Mr. D. D. Briggs was some time ago appointed general foreman of the New Orleans shops of the Louisville & Nashville. He is a son of Mr. R. H. Briggs, general master mechanic of the Kansas City, Memphis & Birmingham Railroad at Memphis, Tenn., the well-known past president of the Master Mechanics' Association. Mr. D. D. Briggs learned the machinist trade under his father and left the shops for the road. He has been locomotive engineer on the Louisville & Nashville for the last five years.

Mr. Charles E. Henderson, for seven years general manager of the Philadelphia & Reading Coal & Iron Company, has, in addition to his present duties, been chosen second vice-president of the reorganized Philadelphia & Reading Railway, in charge of freight traffic. Mr. Henderson was formerly for a number of years general manager of the Indiana, Bloomington & Western, was for two years receiver of the Danville, Olney & Ohio River Railroad, and from May, 1, 1886, to 1888, was general manager of the Chicago & Ohio River road.

Mr. George F. Evans, since December 1, 1895, assistant general manager of the Boston & Maine, was on November 30th chosen general manager of the Maine Central, to succeed Mr. Payson Tucker. Mr. Evans was superintendent of the Southern division of the Boston & Maine from March 1, 1892, to December 1, 1895, and was formerly for eleven years connected with the Louisville, Evansville & St. Louis, successively as secretary and treasurer, assistant to president, receiver and general manager during receivership, and general manager after reorganization.

Good fortune sometimes comes to railroad men, even in their old age. We are gratified to report the good fortune that has come to John King, a gray-haired switchman at Salamanca, on the Erie Railroad, who owned an 80-acre tract of wild land in the Chipmunk Valley in Cattaraugus County. Oil was struck on his land lately, and to-day he is receiving $250 a week in royalty for its production. Every indication is that the oil wells will bring him a fortune. The day the first well was struck on his land, he gave up his switch key and has decided to risk his future maintenance on the oil wells.

Mr. M. M. Meehan, traveling engineer of the Duluth, South Shore & Atlantic, has left the service of the company to accept a position with the Galena Oil Company. His territory will be on the Grand Trunk, where he will be stationed to instruct railroad people about what Galena oil will do in the way of preventing hot boxes. A correspondent, writing about this change, says: "Although we are very sorry to lose Mike, we are glad to know that he is doing better in the financial part of it at least. He has been highly popular with the enginemen and officers of the road during the nine years he has held the position of traveling engineer."

We are gratified to learn that Mr. W. J. Fransioli, who has been acting general manager of the Manhattan Railroad since the death of Colonel Hain, has received the appointment of general manager. Mr. Fransioli has practically been general manager for the last two or three years, impaired health having prevented Colonel Hain from performing the actual duties of his office. It is a source of great satisfaction to the employés of the Manhattan Railway that the directors have acknowledged the fitness of Mr. Fransioli for the position. He is highly popular with high and low, and has been eminently just in his dealing with the numerous cases of discipline that necessarily come up on that system.

Mr. John Hickey, for the last six years superintendent of motive power and rolling stock of the Northern Pacific, has resigned, on account of ill health. Mr. Hickey has gone through great family affliction since he went to the Northern Pacific, having lost four of his children within three years, which no doubt contributed to a great extent to bring about the sending in of his resignation. Mr. Hickey was previously general master mechanic of the Milwaukee, Lake Shore & Western, and while there gained a high reputation for the able management of his department, a reputation which brought to him the appointment to the Northern Pacific. He was for some time president of the Western Railway Club and was two years president of the American Railway Master Mechanics' Association. He takes a very active interest in the affairs of this organization.

Mr. Frank S. Gannon, who has for the last six or seven years had charge of the Baltimore & Ohio interests in New York City, and was general manager of the Staten Island Rapid Transit, has been elected third vice-president and general manager of the Southern Railway, with headquarters at Washington, D. C. Mr. Gannon is a remarkably able railroad man, and has commended himself to this high position by the skillful and judicious manner in which he managed to keep at bay a variety of interests that were constantly trying to take advantage of the Baltimore & Ohio in New York City. He is a graduate of the Erie, where he began work as a telegraph operator, and he has a great many amusing reminiscences to tell about the way business was transacted on the Erie thirty years ago. He was for a time general superintendent of the New York City & Northern, and his management of that property was no less skillful than the work he did for the Baltimore & Ohio.

Mr. E. M. Herr has been appointed superintendent of motive power and rolling stock of the Northern Pacific, with headquarters at St. Paul, Minn. Mr. Herr has recently been assistant superintendent of motive power of the Chicago & Northwestern, and is one of the best-known of the young, technically educated railroad men of the West. He entered railroad service originally as a telegraph operator, but, realizing the small chances of promotion from that position, and having a turn towards mechanics, he determined to obtain the education imparted by a good engineering school. After graduating, he went into the test department of the Chicago, Burlington & Quincy, where he remained several years. He left that to be master mechanic of the Chicago, Milwaukee & St. Paul, which he left to accept the position of superintendent of the Grant Locomotive Works in Chicago. Some of the best engineering papers that have been presented to the Western Railway Club and to the American Railway Master Mechanic' Association have been prepared by Mr. Herr, and he has done very valuable engineering work in connection with the locomotive testing plant belonging to the Chicago & Northwestern.

Mr. David Leonard Barnes, the well-known consulting engineer and editorial writer, died last month in New York, at the age of 38 years. Mr. Barnes was born in Rhode Island in 1858. He received a good technical engineering training at Brown University and at the Massachusetts Institute of Technology. From the latter institution he went to the Rhode Island Locomotive Works, and three years later was made chief draftsman. Having been of literary tastes, he began writing to the railroad and engineering papers on mechanical problems. This naturally led him towards journalism, and about ten years ago he went West and joined the editorial staff of the "Railway Review." Shortly afterwards he changed to the staff of the "Railroad Gazette" and was connected with it at the time of his death. He continued his residence in Chicago, did consulting engineering work, and by degrees secured quite a lucrative business in that line. He was a young man of tremendous energy and industry, and took a leading part in a variety of engineering societies. Of late he has been consulting engineer for the Baldwin Locomotive Works and Westinghouse Electric Manufacturing Company, in their combined work in the development of electric locomotives. His untimely death put an end to a career that promised to be great and useful.

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The compressed-air locomotive which has been under construction for the New York Elevated Railroad for some time, is finished and will be ready for service as soon as the air compressor is ready for work. The engine is built under the Hardie patents, and the machinery is of the same design as that used on the air motor working on One Hundred and Twenty-fifth street, New York. There was a compressed-air engine, designed by Mr. Hardie, tried on the elevated railways about fifteen years ago, and it worked fairly well, although the compressed air was only about 900 pounds per square inch. The new motor will start out with a pressure of 2,000 pounds, and will possess several features conducive to economy of air, which were wanting in the first engine tried.

EQUIPMENT NOTES.

The Illinois Central has recently ordered 1,000 cars.

The Wilmington & Northern is in the market for 200 cars.

The Toledo, St. Louis & Kansas City has ordered 500 gondola cars.

The St. Louis & San Francisco is getting 300 freight cars built at St. Charles.

The Southern Railway is reported to be in the market for a lot of new locomotives.

The Wisconsin Central has placed an order for 1,000 cars with Haskell & Barker.

The Rogers Locomotive Works has received an order for eighteen Moguls for Japan.

The Florida Central & Peninsular has ordered two passenger cars from Jackson & Sharp.

The Rio Grande Southern has ordered eight passenger cars from the Ohio Falls Company.

The Louisville, Evansville & St. Louis has ordered one passenger car from the Ohio Falls Company.

The Berind-White Coal Mining Company has ordered 150 freight cars from the Middletown Car Works.

The Southern Railway has ordered four combination vestibule, passenger and baggage cars from Pullman.

The Delaware, Lackawanna & Western management talk of ordering some new locomotives before the month is out.

The Brooks Locomotive Works is building five ten-wheel freight engines for the Nickel Plate, and some others for the Butte, Anaconda & Pacific.

The Boston & Maine has placed an order with the Rhode Island Locomotive Works for twenty engines, and with the Manchester Works for five more.

The Illinois Central are putting the standard coupler and platform upon a number of their suburban cars. This coupler and platform has lately been applied to some Pullman sleepers.

The manufacturers of woodworking machinery are said to be trying to form an organization for self-protection and preservation, similar to one formed some years ago by locomotive builders.

President Diaz, of Mexico, has ordered three magnificent cars from Barney & Smith Car Company. The cars will constitute the president's private train, and will consist of dining car, sleeper and library car.

The Dickson Locomotive Works, Scranton, Pa., are rebuilding five engines for the Erie & Wyoming and one for the Ontario & Western. They have also a number of mining locomotives that they are working at.

The Schenectady Locomotive Works

have recently received an order for five heavy ten-wheelers for the Southern Pacific, and several ten-wheelers suitable for passenger or freight for the Michigan Central. They are also building four engines for the Boston & Albany, and five for the Midland Terminal of Colorado.

Among recent orders given to the Baldwin Locomotive Works is one engine for the Chicago & West Michigan, seven for the Norfolk & Western, one for the New York, Philadelphia & Norfolk, two for the Erie, and ten for the Kansas City, Pittsburgh & Gulf. It is also reported that they have received an order from China for some engines.

The Tyler Tube & Pipe Company, of Washington, Pa., have the contract to furnish the knobbled hammered charcoal iron boiler tubes required in the new battleships Nos. 7 and 8, as well as the tubes for the water-tube boilers in the United States steamer "Chicago." They have lately completed the order for tubes for the United States vessels "New York," "Columbia," "Minneapolis," "Castine," and the ram "Katahdin."

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(1) W. W., Lafayette, Ind., writes:

Can you tell me where I can get any hints as to balancing driving wheels? A.—The report of proceedings of the American Railway Master Mechanics' Association for 1896 contains the information you ask for, set forth by a committee appointed to investigate the best methods for handling the counterbalancing of driving wheels.

(2) C. F. B., Bridgeport, Conn., writes:

Some railroad men claim that they can make better time when the heavy cars (postal, etc.) are in the fore part of the train, than they can when attached to the rear of the train. Will you be kind enough to explain this? A.—Experiments have been made with the dynamometer for the purpose of testing the truth of this proposition, and it has been demonstrated that the pull on the drawbar was exactly the same when the heavy cars were ahead as when they were in the rear of the train.

(3) H. T., Paducah, Ky., writes:

Being a subscriber of your paper, I ask if you will kindly answer the following questions: 1. What are the principal reasons why a Monitor injector refuses to take up water at the overflow? A.—See Answer No. 73 in September, 1896, issue. 2. What causes an engine, while running shut off at a high rate of speed, to give short puffs or exhausts through the stack; would it indicate faulty valve motion? A.—A leaking throttle valve would produce such an effect. 3. What causes the drumming or roaring noise frequently made by engines? A.—Explosion of minute quantities of gas in the firebox in rapid succession is what causes this noise.

(4) T. J. M., Jersey City, N. J., writes:

I would like to ask why some engines, when running about 40 miles an hour, wabble or, as some say, "nose." I know of two engines on the P. R. R., one of them Class L and one Class P, that do this, so that it is uncomfortable to ride upon them at high speed. I have tried to solve this problem, but would like someone else's opinion on the matter. A.—The action you speak of is undoubtedly due to a lack of counterbalance of the reciprocating parts. If this horizontal disturbance is eliminated by a correct balance of the unbalanced forces, there will be found a new trouble in the shape of a vertical disturbance, for the reason that when the wheels are properly balanced for the revolving weights, any attempt to balance the reciprocating parts will destroy the revolving balance vertically, and it is this vertical overbalance with its hammering action that is sought to be avoided. Between two evils the lesser one is usually taken, and that will probably account for the "nosing."

(5) J. W., St. Paul, Minn., writes:

We have a logging engine here that weighs about 40 tons with coal and water. It has a saddle tank and a four-wheeled truck under the coal bunker. Engine has run nearly two years and is cutting the flanges on all driving wheels and truck wheels. Forward driving wheel flanges are cut the worst. Total rigid wheelbase is 23 feet. Tires are not worn at all on tread. What is best to do with the engine—run the tires as long as possible and then turn them off? A.—Turn the tires before the flanges have become too thin. This should be done as a measure of economy, for the reason that the tread of the tires will have to be sacrificed too greatly in order to bring up the flanges to the proper thickness if turning is deferred too long. 2. How thin can the flanges be allowed to get? A.—They should not be run at less than 1 inch thick for the above reason. 3. What is the cause of the tires cutting on all the wheels? A.—The cause can probably be traced to the curves on your road. 4. How much does a new set of tires cost for four wheels? A.—The cost will depend on the diameter and thickness of tires, which information you do not furnish; you may, however, determine this for yourself by calculating the weight of them and computing the cost at about 4 cents per pound. 5. How much is it worth to take the wheels out from under the engine, and replace them after turning the tires? A.—The cost of this work hinges entirely on the facilities for doing it, and the price of labor. It will take two machinists and two laborers one day or more, under ordinary conditions, to disconnect and raise the engine off her wheels and onto the blocks, with the common screw jack, and a like time to put her on the wheels again and couple up. The cost of turning the tires will depend on the amount of material removed, their degree of hardness, and the price paid for labor. On the basis of ten hours to the pair, the four wheels would require two days. The entire cost would therefore range anywhere from $20 to $40, or even more if the turning was hired done in an outside shop, where a round figure is usually charged for the use of tools.

Besides investing in a great deal of first-class rolling stock, the new management of the Baltimore & Ohio are making a great deal of improvement in the shops where repairs are to be carried on. They are putting up a new locomotive repair shop at Baltimore.

The electrical operation of the South Shore branch of the Old Colony part of the New York, New Haven & Hartford system, has worked so satisfactorily that the management is reported to be preparing to introduce electrical traction on the branch between New Britain and Hartford. The system employed will be the same as that used on the South Shore branch. A third rail, insulated upon wooden blocks in the center of the track, is used as a conductor, and remarkably few delays have occurred through derangement of the electrical apparatus.

The Manhattan Elevated Railway Company of New York have fitted up one of their locomotives to burn oil and are experimenting with it in train service. There appears to be no difficulty, as might be expected, in making the engine steam all right, and this one seems to give entire satisfaction. To judge from the experience of other roads where coal is cheap, the only difficulty in making a success of the oil burner on the Elevated is on the score of expense, for, unless under exceptional circumstances, coal is cheaper than oil.

At the last meeting of the American Society of Mechanical Engineers the secretary gave public notice that the society would no longer supply the annual report free to libraries, institutions of learning and other places which nearly always apply for complimentary copies. This is a movement which other societies will soon have to take part in. There are certain libraries and seats of learning which always expect publications free, although in many cases they are better able to pay than the donors are able to give free.

A somewhat curious practice has been adopted by Mr. G. W. Stevens, superintendent of motive power of the Lake Shore & Michigan Southern, in securing bolts on locomotives. Instead of using cotters or split pins, he puts in a copper rivet and rivets the end. This has to be cut out before a bolt can be removed. It has the effect of preventing men from taking out bolts except in cases of absolute necessity, and it is found more reliable than a cotter or split pin.

The Northwestern Railway Club is becoming noted for the highly practical character of the papers read by the members. The discussions are also about as good as the papers. Among twenty-four new members admitted to the club at one meeting there were seventeen foremen, one general superintendent, one assistant general superintendent, two foundrymen, one air-brake inspector, one master mechanic and one lumber agent.

Buyers' Finding List.

(Continued on page 74.)

BUYERS' FINDING LIST—*Continued.*

BORING AND TURNING MILLS.
Betts Machine Co., Wilmington, Del.
Davis & Egan Machine Tool Co., Cincinnati, O.
Hill, Clarke & Co., Boston, Mass.

BOXES FOR SHAFTING.
P. Pryibil, New York City.

BRACKET (RUNNING BOARD).
Dayton Malleable Iron Co., Dayton, O.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE FORKS.
Dayton Malleable Iron Co., Dayton, O.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
The Sargent Co., Chicago, Ills.

BRAKE WHEEL.
Dayton Malleable Iron Co., Dayton, O.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BRIDGE AND STRUCTURE PAINT.
Standard Paint Co., New York.

BUFFERS.
Gould Coupler Co., Buffalo, N. Y.
Pryibil, P., New York.

BUILDING AND SHEATHING PAPERS.
Standard Paint Co, New York.

BULLDOZERS
Williams, White & Co., Moline, Ill.

BUOY LIGHTING.
Safety Car Heating & Lighting Co., New York.

CARS.
Allison Mfg. Co., Philadelphia, Pa.
J. G Brill Co., Philadelphia, Pa.
Lima Locomotive & Machine Co., Lima, O.
Ramapo Iron Works, Hillburn, N. Y.

CAR AXLES.
Dickson Locomotive Works, Scranton, Pa.

CAR COUPLERS.
Gould Coupler Co., Buffalo, N. Y.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
St. Louis Car Coupler Co., St. Louis, Mo.
Sams Automatic Coupler Co., Denver, Col.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

CAR DOORS.
National Malleable Castings Co., Chicago, Ill.

CAR DOOR FASTENERS.
Dayton Malleable Iron Co., Dayton, O.
National Malleable Castings Co., Chicago, Ill.

CAR FORGINGS.
Dickson Locomotive Works, Scranton, Pa.
Peerless Rubber Mfg. Co., New York.

CAR HEATING.
William C. Baker, New York.
Safety Car Heating & Lighting Co., New York.

CAR HEATING HOSE.
Boston Belting Co, Boston, Mass.
N. Y. Belting & Packing Co., New York.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR ROOFING.
Standard Paint Co., New York.

CAR SEATS.
Hale & Kilburn Mfg. Co, Philadelphia, Pa.
Scarritt Furniture Co., St. Louis, Mo

CAR SHOP TOOLS.
Niles Tool Works Co., Hamilton, O.
Prentice Bros., New York.

CAR SEAT SPRINGS.
W. D. Gibson Co., Chicago, Ill.

CAR STEP TREADS.
Boston Belting Co., Boston, Mass.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.
Palmer Car Ventilator Co., Boston, Mass.

CAR WHEEL BORERS.
Betts Machine Co., Wilmington, Del.
Prentiss Tool Supply Co., New York.

CAR WHEELS.
Krupp (T. Prosser & Son, New York).
Lima Locomotive & Machine Co., Lima, O.
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
Standard Steel Works, Philadelphia, Pa.

CARS, LIGHT RAILWAY.
Kalamazoo Railroad V. R. Co, Kalamazoo, Mich

CASTINGS.
Ramapo Wheel & Foundry Co, Ramapo, N.Y.
Cook Locomotive & Machine Co., Paterson, N. J.
National Malleable Castings Co., Chicago, Ill.
The Sargent Co., Chicago, Ill.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CENTER INDICATORS.
J. Stevens Arms & Tool Co, Chicopee Falls, Mass.

CHANNELERS.
Ingersoll-Sergeant Drill Co., New York.

CLAMPS, TOOL MAKERS'.
Armstrong Mfg. Co., New York.
J. Stevens Arms & Tool Co., Chicopee Falls, Mass.

CLEANING MATERIAL.
Alkali Works, Boston, Mass.

CLOCKS.
John J. McGrane, New York.

CLUTCHES.
American Tool & Machine Co., Boston, Mass.

COAL CHUTES.
Williams, White & Co., Moline, Ill.

COAL HANDLING MACHINERY.
Ingersoll-Sergeant Drill Co., New York.
Link Belt Engineering Co., Philadelphia, Pa.
The Pratt & Whitney Co, Hartford, Conn.

COAL PICKS.
Dayton Malleable Iron Co., Dayton, O.

COMPRESSED AIR LOCOMOTIVES.
Dickson Locomotive Works, Scranton, Pa.
H. K. Porter & Co., Pittsburgh, Pa.

CORRESPONDENCE SCHOOLS.
Internat'l Corres. Schools, Scranton, Pa.

CORUNDUM WHEELS.
Norton Emery Wheel Co., Worcester, Mass.

COUPLER SPRINGS.
Wm. S Gibson Co., Chicago.

COUPLING CEMENT.
Boston Belting Co., Boston, Mass.

CRANES.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia, Pa.
Pedrick & Ayer Co., Philadelphia, Pa.
William Sellers & Co., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANK PIN GAGES.
M. C. Hammett, Troy, N. Y.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

CUTTERS, STAY-BOLT.
Acme Machinery Co., Cleveland, O.

DAMPER REGULATORS.
Mason Regulator Co., Boston, Mass.

DRAW BAR ATTACHMENT.
Butler Draw Bar Co., Cleveland, O.

DRAWING AND DESIGNING.
W. D. Forbes & Co., Hoboken, N. J.

DRILL RODS.
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLS
Armstrong Bros. Tool Co., Chicago, Ill.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Pedrick & Ayer Co, Philadelphia, Pa.
Prentice Bros., New York.
The Pratt & Whitney Co., Hartford, Conn.

DRILLING MACHINES.
Hill, Clarke & Co., Boston, Mass.
Gould & Eberhardt, Newark, N J.
The Pratt & Whitney Co., Hartford, Conn.
Prentice Bros., New York.

ELECTRIC LIGHTING AND POWER APPARATUS.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa

EJECTORS.
Hancock Inspirator Co., Boston, Mass.

EMERY WHEELS.
Armstrong Bros. Tool Co., Chicago, Ill.
Norton Emery Wheel Co., Worcester, Mass.

ENGINES.
St. Louis Steam Engine Co., St. Louis, Mo.

ENGRAVINGS.
Bradley & Poates, New York.

FILES AND RASPS.
Arcade File Co., New York.
Armstrong Bros. Tool Co., Chicago, Ill.
Nicholson File Co., Providence, R. I.

FIRE BRICK.
Garden City Sand Co., Chicago, Ill.

FIRE HOSE.
Boston Belting Co., Boston, Mass.
Peerless Rubber Mfg. Co., New York.

(*Continued on page 75.*)

BUYERS' FINDING LIST—*Continued.*

FIREPROOF HEATERS.
W. C. Baker, New York.

FLEXIBLE SHAFT.
Stow Flexible Shaft Co., Philadelphia, Pa.

FLEXIBLE STEAM JOINT.
Moran Flexible Steam Joint Co., Louisville, Ky.

FLUES AND TUBES.
Allison Mfg. Co., Philadelphia, Pa.
Tyler Tube & Pipe Co., Washington, Pa.

FORGES.
Armstrong Bros. Tool Co., Chicago, Ill.
The Bradley Co., Syracuse, N. Y.
Buffalo Forge Co., Buffalo, N. Y.

FORGINGS, LIGHT.
W. D. Forbes & Co., Hoboken, N. J.
Cambria Iron Co., Philadelphia, Pa.

FROGS AND CROSSINGS.
Ramapo Iron Works, Hillburn, N. Y.

FROG AND SWITCH POINT PLANERS.
Prentiss Tool & Supply Co., New York.

GAGES.
Ashcroft, 111 Liberty street, New York.
Crosby Steam Gage & Valve Co., Boston, Mass.
Star Brass Mfg. Co., Boston, Mass.
Utica Steam Gage Co., Utica, N. Y.

GAS COMPRESSORS.
Norwalk Iron Works Co., So. Norwalk, Conn.

GAS ENGINES.
W. D. Forbes & Co., Hoboken, N. J.

GASKETS AND RINGS.
Boston Belting Co., Boston, Mass.

GASOLINE MOTOR INSPECTION CARS.
Kalamazoo Railroad Velocipede & Car Co. Kalamazoo, Mich.

GRAPHITE.
Jos. Dixon Crucible Co., Jersey City, N. J.

HAMMERS.
The Bradley Co., Syracuse, N. Y.
Williams, White & Co., Moline, Ill.

HAND PRE›SURE PUMPS.
W. D. Forbes & Co., Hoboken, N. J.

HANGERS.
American Tool & Machine Co., Boston, Mass.
The Pratt & Whitney Co., Hartford, Conn.
P. Pryibil, New Yoik City.

HEATING SYSTEM FOR SHOPS.
Buffalo Forge Co.
Gold Car Heating Co., New York.

HOLDERS FOR BRASS AND NICKEL-PLATED PIPE.
Armstrong Mfg. Co., New York.

HOLLOW STAYBOLTS.
Falls Hollow Staybolt Co., Cuyahoga Falls, O.

HOSE, AIR-BRAKE STEAM AND WATER.
Mercer Rubber Co., New York.
Boston Belting Co., New York.

HOT WATER CAR AND HOUSE HEATERS.
W. C. Baker, New York.

HYDRAULIC CAR WHEEL PRESSES.
Prentiss Tool & Supply Co., New York.
The Watson-Stillman Co., New York.

HYDRAULIC CRANK PIN PRESSES.
The Watson-Stillman Co., New York.

HYDRAULIC JACKS.
R. Dudgeon, New York.
The Watson-Stillman Co., New York.

HYDRAULIC PRESSES.
R. Dudgeon, New York.
The Watson-Stillman Co., New York.

HYRDAULIC PUMPS.
The Watson-Stillman Co., New York.

HYDRAULIC PUNCHES.
R. Dudgeon, New York.
The Watson Stillman Co., New York.

HYDRAULIC RAIL BENDERS.
The Watson-Stillman Co., New York.

HYDRAULIC RAIL PUNCHES.
The Watson-Stillman Co., New York.

HYDRAULIC TOOLS.
Richard Dudgeon, New York
The Watson-Stillman Co., New York.
R. D. Wood & Co., Philadelphia, Pa.

HYDRAULIC TRANSFER JACKS.
The Watson-Stillman Co., New York.

INDICATORS.
Ashcroft Mfg. Co., New York
Crosby Steam Gage and Valve Co., Boston.
The Pratt & Whitney Co., Hartford, Conn.

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BUYERS' FINDING LIST—*Continued.*

INJECTORS.
Detroit Lubricator Co., Detroit, Mich.
Hancock Inspirator Co., Boston, Mass.
Hayden & Derby Mfg. Co., New York.
Nathan Mfg. Co., New York.
Rue Mfg. Co., Philadelphia, Pa.
William Sellers & Co., Philadelphia, Pa.

INSPECTION HAND CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

INSPECTION RAILWAY.
R. W. Hunt Co., Chicago, Ill.

INSPIRATORS.
Hancock Inspirator Co., Boston, Mass.

INSULATING COMPOUNDS, PAPERS AND TAPE.
Standard Paint Co., New York.

JACKS.
E. C. Boyer, Dayton, O.
Richard Dudgeon, New York.
A. L. Henderer, Wilmington, Del.
A. O. Norton, Boston, Mass.
Watson & Stillman, New York.

JOURNAL BOXES AND LIDS.
National Malleable Castings Co., Chicago, Ill.

KEROSENE OIL BOILER FEEDERS.
Detroit Lubricator Co., Detroit, Mich.

LAGGINGS FOR LOCOMOTIVES.
H. W. Johns Mfg. Co., New York.
Keasbey & Mattison Co., Ambler, Pa.

LATHE DOGS.
Armstrong Mfg. Co., New York.

LATHES.
Hill, Clarke & Co., Boston, Mass.
Prentice Bros., New York.
Bement, Miles & Co., Philadelphia, Pa.
Betts Machine Co., Wilmington, Del.
Davis & Egan Machine Tool Co., Cincinnati, O.
W. D. Forbes & Co., Hoboken, N. J.
Gould & Eberhardt, Newark, N. J.
Jones & Lamson Machine Co., Springfield, Vt.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.
Newton Machine Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
William Sellers & Co., Inc., Philadelphia, Pa.

LATHE TOOLS.
Armstrong Bros. Tool Co., Chicago, Ill.

LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Loco. & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa.
Lima Locomotive & Machine Co., Lima, O.
Pittsburg Locomotive Works, Pittsburg, Pa.
H. K. Porter & Co., Pittsburg, Pa.
Richmond Loco. & Mch. Wks., Richmond, Va.
Rogers Locomotive Works, Paterson, N. J.
Schenectady Loco. Wks., Schenectady, N. Y.

LOCOMOTIVE CASTINGS, MODEL.
G. H. Olney, Brooklyn, N. Y.

LOCOMOTIVE DRIVING WHEEL LATHES.
Prentiss Tool & Supply Co., New York.

LOCOMOTIVE LAGGING.
Keasbey & Mattison Co., Ambler, Pa.

LOCOMOTIVE MACHINERY.
Niles Tool Works Co., Hamilton, O.

LOCOMOTIVE SPEED RECORDERS.
Crosby Steam Gage & Valve Co., Boston, Mass.

LOCOMOTIVE STAYBOLT IRON.
Fails Hollow Staybolt Co., Cuyahoga Falls, O.

LOCOMOTIVE WHEEL TIRES.
Krupp (J. Prosser & Son), New York.
Latrobe Steel Co., Philadelphia, Pa.

LUBRICATORS.
Detroit Lubricator Co., Detroit, Mich.
M. C. Hammett, Troy, N. Y.
Nathan Mfg. Co., New York.

LUBRICATING OILS.
Galena Oil Works, Ltd., Franklin, Pa.
Leonard & Ellis, New York.
Signal Oil Works, Franklin, Pa.

MACHINISTS' AND WOOD-WORKERS' CLAMPS.
Armstrong Bros. Tool Co., Cleveland, O.

MACHINE TOOLS.
Bement, Miles & Co., Philadelphia, Pa.
Betts Machine Co., Wilmington, Del.
Davis & Egan Machine Tool Co., Cincinnati, O.
W. D. Forbes & Co., Hoboken, N. J.
Gould & Eberhardt, Newark, N. J.
Jones & Lamson Machine Co., Springfield, Vt.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.
Newton Machine Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool and Supply Co., New York.
William Sellers & Co., Inc., Philadelphia, Pa.

(*Continued on page 77.*)

BUYERS' FINDING LIST *Continued.*

MACHINISTS' SMALL TOOLS.

Callipers, dividers, cutting nippers, surface gages, Universal threading tool, compasses, scratch gage, Universal beval, center indicators, Universal center square.

J. Stevens Arms & Tool Co., Chicopee Falls, Mass

Callipers, files, hack saws, milling cutters, tool holders, vises.

Armstrong Bros., Tool Co., Chicago, Ill.

MACHINERY.

Railroad, Locomotive, Car.

Niles Tool Works Co., Hamilton, O

Car link and pin, wire nail, automatic cold rivet.

National Machinery Co, Tiffin, O.

Railroad,

Rogers Locomotive Co., Paterson, N. J.

Mining, quarrying.

Rand Drill Co., New York.

MACHINES.

Air drilling.

C. H. Haesler & Co., Philadelphia, Pa.

Air, ice, automatic tapping and reaming, tapping, special drilling and tapping.

W. D. Forbes & Co, Hoboken, N. J.

Automatic cold rivet, Forming and bending, spike, washer, nut, nut tapping, forming and bending, car link and pin, wire nail, head shaving and trimming.

National Machinery Co., Tiffin, O.

Automatic spacing and punching.

Long & Allstatter Co., Hamilton, O.

Boring and drilling.

Betts Machine Co, Wilmington, Del.

Car boring, cutting-off and centering, cylinder boring, metal planing, portable valve, seat milling, slotting, Universal milling.

Prentice Bros., New York
Prentiss Tool & Supply Co, New York.

Screw cutting dies, metal sawing.

Armstrong Mfg. Co, New York.

Forging.

Pratt & Whitney Co, Hartford, Conn.
Williams, White & Co, Moline, Ill.

Gear-cutting, grinding and polishing screws.

Hill, Clarke & Co., Boston, Mass

Metal sawing.

Newton Machine Tool Works, Philadelphia, Pa.
Pratt & Whitney Co, Hartford, Conn.
Q. & C, Chicago, Ill.

Moulding.

Tabor Mfg. Co, New York.

Ticket cancelling.

Ingersoll Sergeant Drill Co., New York.

MAGNESIA LAGGING.

Keasbey & Mattison Co, Ambler, Pa.

MALLEABLE IRON CASTINGS.

National Malleable Castings Co., Chicago.

MECHANICAL BOOKS.

D. Van Nostrand Co., New York.
John Wiley & Sons, New York.

METAL POLISH.

G. W. Hoffman Indianapolis Ind.

METAL SAWING MACHINES.

Armstrong Mfg. Co., New York.
Newton Machine Tool Works, Phila, Pa.
Pratt & Whitney Co., Hartford, Conn.
Q. & C. Co., Chicago, Ill.

MILLING CUTTER AND ARBORS.

W. D. Forbes & Co., Hoboken, N. J.

MILLING MACHINES

Cincinnati Milling Machine Co, Cincinnati, O.
Hill, Clarke & Co., Boston, Mass
Newton Machine Tool Works, Phila., Pa.
Pedrick & Ayer Co., Philadelphia, Pa.
Pratt & Whitney Co Hartford, Conn.
Prentiss Tool & Supply Co., New York.

(Continued on page 78.)

BUYERS' FINDING LIST—*Continued.*

MINING MACHINERY.
Rand Drill Co., New York.

MODEL LOCOMOTIVES.
Geo. N. Olney, Brooklyn, N. Y.

MOLDING SAND.
Garden City Sand Co., Chicago, Ill.

MOLDING MACHINES.
Tabor Mfg. Co., New York City.

MULTIPLE PUNCHES.
The Long & Allstatter Co., Hamilton, O.

MUFFLED POP SAFETY VALVES.
Crosby Steam Gage and Valve Co., Boston, Mass.

NUT MACHINES.
National Machinery Co., Tiffin, O.
Prentiss Tool & Supply Co., New York.

NUT BURRING MACHINES.
National Machinery Co., Tiffin, O.

NUT TAPPING MACHINES.
National Machinery Co., Tiffin, O.

OIL CUPS.
Detroit Lubricator Co., Detroit, Mich.
Hammitt, M. C., Troy, N. Y.

OIL SEPARATORS.
American Tool & Machine Co., Boston, Mass.

OVER CLOTHES.
H. S. Peters, Dover, N. J.

PACKING.
Boston Belting Co., Boston, Mass.
Gould Packing Co., East Cambridge, Mass.
H. W. Johns Mfg. Co., New York.
Jenkins Bros., New York.
N Y Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.
U. S. Metallic Packing Co., Philadelphia, Pa.

PAINTS.
Detroit Graphite Mfg. Co , Detroit, Mich.
H. W. Johns Mfg. Co , New York.
Standard Paint Co., New York.

PATENTS.
O. Knight, New York.
John Wedderburn & Co., Washington, D. C.
George P. Whittlesey, Washington, D. C.

PERFORATED METAL.
A. J. Beckley & Co., Meriden, Conn.
Harrington & King Perforating Co., Chicago, Ill.
The Hendrick Mfg. Co., Ltd., Carbondale, Pa.

PHOTOGRAPHS.
F. Moore, London, Eng.

PIPE CUTTERS.
Armstrong Manufacturing Co., New York.

PIPE FITTINGS.
W. C. Barker, New York.

PIPE FLANGES.
Latrobe Steel Co , Philadelphia, Pa.

PIPE THREADING AND CUTTING MACHINERY.
Armstrong Mfg. Co., Bridgeport, Conn.
W. D. Forbes & Co., Hoboken, N. J.
Bignall & Keeler Mfg. Co., Edwardsville, Ills.
Hill, Clarke & Co., Boston, Mass
D. Saunders' Sons, Yonkers, N. Y.

PIPE VISES.
Armstrong Manufacturing Co., New York.

PISTOLS.
J. Stevens Arms & Tool Co., Chicopee Falls, Mass.

PISTON RODS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Thomas Prosser & Son, New York.

PIT OR MINING CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

PLANE MILLERS.
W. D. Forbes & Co., Hoboken, N. J.

PLANERS.
Betts Machine Co., Wilmington, Del.
Hill, Clarke & Co , Boston, Mass.
Prentiss Tool & Supply Co., New York.

PNEUMATIC TOOLS.
Chicago Pneumatic Tool Co., Chicago, Ill.
C H. Haeseler & Co., Philadelphia, Pa.
Pedrick & Ayer Co , Philadelphia.
U. S. Metallic Packing Co., Philadelphia.

POHLE AIR LIFT PUMP.
Ingersoll Sergeant Drill Co., New York.

POP SAFETY VALVES.
Crosby Steam Gage & Valve Co , Boston, Mass
Star Brass Mfg. Co., Boston, Mass.

POWER HAMMERS.
The Bradley Co., Syracuse, N. Y.

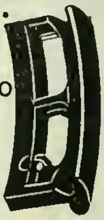
(*Continued on page 79.*)

THE
ALLISON MFG. CO.,
MANUFACTURERS OF
FREIGHT CARS AND LOCOMOTIVE BOILER TUBES.
WROUGHT IRON PIPE OF SUPERIOR QUALITY.

PHILADELPHIA, PA.

THE SARGENT COMPANY
OLD COLONY BLD'G CHICAGO ILL.
ST. LOUIS, CINCINNATI, SAN FRANCISCO ST. PAUL, TACOMA, PORTLAND.

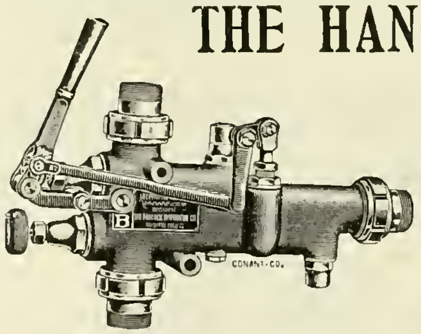




STEEL CASTINGS

BRAKE SHOES

THE HANCOCK INSPIRATOR.

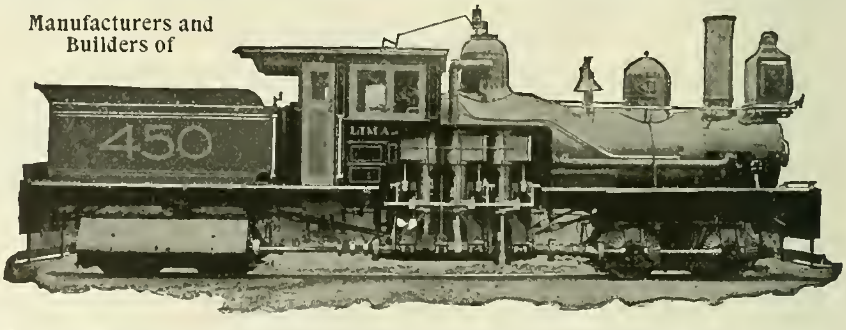


Interchangeable with all standard Injectors in use. Capacities INCREASE as steam pressure increases. Minimum capacity, less than fifty per cent. (50%) of the maximum. ABSOLUTELY NO ADJUSTMENT of either steam or water supply under steam pressures of from 35 TO 200 LBS. AND HIGHER. Durability, absolute reliability, highest degree of efficiency, and greater range of capacity than any Injector in use GUARANTEED.

THE HANCOCK INSPIRATOR COMPANY, Boston, Mass.

THE LIMA LOCOMOTIVE AND MACHINE COMPANY, LIMA, OHIO.

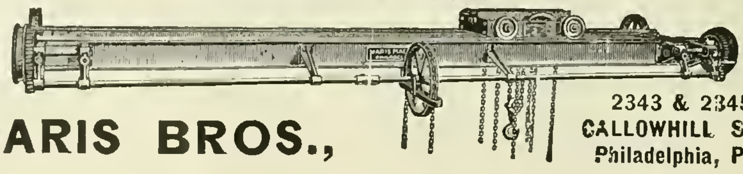
Manufacturers and Builders of



Shay Patent and Direct Connected Locomotives, Freight and Caboose Cars, all kinds of Steel Castings, Brass and Gray Iron Castings, Car Wheels and Railroad Work.

CORRESPONDENCE SOLICITED.

CRANES, TROLLEYS, PORTABLE HOISTS, OVERHEAD TRACK.
SEND FOR CATALOGUE.



MARIS BROS.,

2343 & 2345 CALLOWHILL ST., Philadelphia, Pa.

BUYERS' FINDING LIST—*Continued.*

POWER AXLE LATHES.
Prentiss Tool & Supply Co., New York.

PRESSES.
R. Dudgeon, New York.
The Watson Stillman Co., New York.

PRESERVATIVE PAINTS.
Standard Paint Co., New York.

PRESSURE REGULATORS.
Foster Engineering Co., Newark, N. J.
Mason Regulator Co., Boston, Mass.
Newark Regulator Co., Newark, O.

PUBLISHERS.
D. Van Nostrand Co., New York.
John Wiley & Sons, New York.

PUMPS.
The Watson Stillman Co., New York.

PUMPS, AIR LIFT.
Rand Drill Co., New York.

PUMP VALVES.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

PULLEYS.
American Tool & Machine Co., Boston, Mass.

PUNCHES AND SHEARS.
The Long & Allstatter Co., Hamilton, O.
The Watson-Stillman Co., New York.

PUNCHING AND SHEARING MACHINERY.
Long & Allstatter Co., Hamilton, O.
Williams, White & Co., Moline, Ill.
R. D. Wood & Co., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.

PUSH CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

QUARRYING MACHINERY.
Ingersoll-Sargeant Drill Co., New York.
Rand Drill Co., New York.

RADIAL DRILLS.
Prentice Brothers, New York.
Prentiss Tool & Supply Co., New York.

RAIL BENDERS.
Watson & Stillman, New York.

RAIL OR CONSTRUCTION CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

RAILWAY CYCLES.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

RAILWAY FENCES.
Page Woven Wire Fence Co., Adrian, Mich.
Peerless Rubber Mfg. Co., New York.

RAILROAD MACHINERY.
Niles Tool Works Co., Hamilton, O.

RAILROAD VELOCIPEDE.
Kalamazoo Railroad V. & C. Co., Kalamazoo, Mich.

RAILS.
Cambria Iron Co., Philadelphia, Pa.

RAPID FIRE MACHINE GUNS.
W. D. Forbes & Co., Hoboken, N. J.

RASPS.
Nicholson File Co., Providence, R. I.

RECORDING GAGES.
Crosby Steam Gage and Valve Co., Boston, Mass.

REDUCING VALVES.
Mason Regulator Co., Boston, Mass.

REGULATORS.
Mason Regulator Co., Boston, Mass.

RETAINING RINGS.
Ramapo Wheel & Foundry Co., Ramapo, N.Y.

REVOLUTION COUNTERS.
Crosby Steam Gage and Valve Co., Boston, Mass.

RIFLES.
J. Stevens Arms & Tool Co., Chicopee Falls, Mass.

ROCK DRILLS.
Rand Drill Co., New York.
Ingersoll-Sergeant Drill Co., New York.

ROOF PAINTS.
Standard Paint Co., New York.

ROLLER TUBE EXPANDERS.
R. Dudgeon, New York.
Mercer Rubber Co., New York.

RUBBER.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.

RUBBER MATS AND MATTING.
Boston Belting Co., Boston, Mass.

(Continued on page 80.)

BUYERS' FINDING LIST—*Continued.*

SAFETY VALVES.
- Ashton Valve Co., Boston, Mass.
- Coale Muffler and Safety Valve Co., Baltimore, Md.
- Consolidated Valve Co., Bridgeport, Conn
- Crosby Steam Gage & Valve Co., Boston Mass.
- Star Brass Mfg. Co., Boston, Mass.

SANDING APPARATUS.
- Henry L. Leach, North Cambridge, Mass.
- Sherburne & Co., Boston, Mass.

SCREW STAYBOLT CUTTER.
- Acme Machine Co, Cleveland, O.

SELF-HARDENING STEEL.
- W. Jessop & Sons, New York.

SHAFTING.
- American Tool & Machine Co, Boston, Mass
- William Sellers & Co., Philadelphia, Pa

SHAPERS.
- Hill, Clarke & Co, Boston, Mass.

SHEARS AND PUNCHES.
- Long & Allstatter Co., Hamilton, O.
- National Machine Co., Tiffin, O.

SHOT GUNS.
- J. Stevens Arms & Tool Co., Chicopee Falls, Mass.

SLOTTING MACHINES.
- Betts Machine Co, Wilmington, Del.
- Prentiss Tool & Supply Co., New York.

SNOW PLOWS, STEAM ROTARY AND STREET RAILWAY.
- Cooke Loco. & Machine Co., Paterson, N. J.

SOFT STEEL PIPE FLANGES.
- Latrobe Steel Co., Philadelphia, Pa.

SPARK ARRESTER PLATE.
- A. J. Beckley & Co., Meriden, Conn.
- Harrington & King Perforating Co., Chicago, Ill
- Hendrick Mfg. Co., Carbondale, Pa.

SPLICE-BAR PUNCHES.
- The Long & Allstatter Co., Hamilton, O.

SPIKE MACHINES.
- National Machine Co., Tiffin, O.

SPRINGS.
- A. French Spring Co., Pittsburg, Pa.
- W. D. Gibson Co., Chicago, Ill.

SPRING STEEL.
- Thomas Prosser & Son, New York.
- Wm. Jessop & Sons, Ltd, New York.

STAYBOLTS.
- Falls Hollow Stay-Bolt Co., Cuyahoga Falls, O.
- B. M. Jones & Co., Boston, Mass.

STAYBOLT CUTTERS.
- Acme Machinery Co., Cleveland, O.

STEAM ATTACHMENTS.
- W. C. Baker, New York.

STEAM FIRE EXTINGUISHERS.
- Nathan Mfg. Co., New York.

STEAM GAGES.
- Crosby Steam Gage & Valve Co., Boston.
- Star Brass Mfg. Co., Boston, Mass.
- Utica Steam Gage Co., Utica, N. Y.

STEAM HAMMERS.
- Bement, Miles & Co., Philadelphia, Pa.
- R. Dudgeon, New York.

STEAM HOSE.
- Boston Belting Co., Boston, Mass.
- Mercer Rubber Co., New York.
- N. Y. Belting & Packing Co., New York.
- Peerless Rubber Mfg. Co., New York.

STEAM INSPECTION CARS.
- Kalamazoo Railroad Velocipede & Car Co, Kalamazoo, Mich.

STEAM PUMPS.
- A. S. Cameron Steam Pump Works, New York
- Mason Regulator Co., Boston, Mass.

STEAM TRAPS.
- Mason Regulator Co., Boston, Mass.

STEEL.
- Cambria Iron Co, Philadelphia, Pa.
- Carbon Steel Co., Pittsburgh, Pa.
- W. Jessop & Sons, Ltd., New York.
- B. M. Jones & Co., Boston, Mass
- Krupp (T. Prosser & Son, New York).
- Latrobe Steel Co, Latrobe, Pa.
- Shoenberger Steel Co., Pittsburg, Pa.

STEEL AXLES.
- Cambria Iron Co., Philadelphia, Pa.

STEEL CASTINGS.
- The Sargent Co, Chicago, Ill.

STEEL, SELF-HARDENING.
- Armstrong Bros. Tool Co., Cleveland, O.

STEEL SUGAR WAGONS.
- Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

(Continued on page 81.)

BUYERS' FINDING LIST—*Continued.*

STEEL SURFACE CATTLE GUARDS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

STEEL TIRED WHEELS.
Krupp (T. Prosser & Son, New York).
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
Standard Steel Works, Philadelphia, Pa.

STEEL TIRES.
Latrobe Steel Works, Latrobe, Pa.
Krupp (T. Prosser & Son New York).
Standard Steel Works, Philadelphia, Pa.

STEEL TRUCK FRAMES.
Fox Solid Pressed Steel Co., Chicago, Ill.

STEEL VELOCIPEDES.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

STEEL WHEEL HAND CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

STOCKS AND DIES.
Armstrong Mfg. Co., Bridgeport Conn
Pratt & Whitney Co., Hartford, Conn.

STREET RAILWAY SUPPLIES.
J. G. Brill Co., Philadelphia, Pa.

SUGAR CANE CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

SURFACE GAUGES.
J. Stevens Arms & Tool Co., Chicopee Falls, Mass.

SWITCH ENGINES.
Rogers Locomotive Co., Paterson, N. J.

SWITCHES
Ramapo Iron Works, Hillburn, N Y.

TAP WRENCHES.
Armstrong Mfg. Co., New York.

TESTS.
R. W. Hunt Co., Chicago.

TIE PLATES.
Q. & C. Co., Chicago, Ill.

THERMOSTATIC WATER-BACK GAGES.
Crosby Steam Gage & Valve Co, Boston, Mass.

TIRES.
Krupp (T. Prosser & Son, New York).
Latrobe Steel Co., Philadelphia, Pa.

TOOL HOLDERS.
Armstrong Bros. Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.

TOOLS.
Nicholson File Co., Providence, R. I.

TOOL STEEL.
Wm. Jessop & Sons, New York.
B M Jones & Co., Boston, Mass.

TORCHES.
Dayton Malleable Iron Co., Dayton, O.

TRACK SANDERS.
H L. Leach, N. Cambridge, Mass.
U. S. Metallic Packing Co., Philadelphia, Pa.

TRUCKS.
J. G. Brill Co., Philadelphia, Pa.

TUBE EXPANDERS.
A. L. Henderer, Wilmington, Del.
R. Dudgeon, New York.

TURNBUCKLES.
Cleveland City Forge & Iron Co., Cleveland, O.

TURNING MILLS.
Davis & Egan Machine Tool Co., Cincinnati, O.

TURRET LATHES.
American Tool & Machine Co., Boston, Mass.

TURRET MACHINES.
Hill, Clarke & Co., Boston, Mass.
Jones & Lamson, Springfield, Vt
Pratt & Whitney Co., Hartford, Conn.

TWIST DRILLS.
Armstrong Bros. Tool Co., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland O.
Pratt & Whitney Co., Hartford, Conn.

TWIST DRILL STEEL.
W. Jessop & Sons, Ltd., New York.

UNIVERSAL MILLING MACHINES.
Prentiss Tool & Supply Co., New York.

VALVE MOTION MODELS.
Pedrick & Ayer Co., Philadelphia, Pa.

VALVES.
Ashton Valve Co., Boston, Mass.
Coale Muffler and Safety Valve Co., Baltimore, Md.
Crosby Steam Gage & Valve Co., Boston, Mass.
Detroit Lubricator Co., Detroit, Mich.
Hancock Inspirator Co., Boston, Mass.
Jenkins Bros., New York.
Star Brass Mfg Co., Boston, Mass.

(*Continued on page 82.*)

BUYERS' FINDING LIST—*Continued.*

VALVES, REDUCING.
Foster Engineering Co., Newark, N. J.
Ross Valve Co., Troy, N. Y.

VALVES, SPRING-SEAT GLOBE AND ANGLE.
Crosby Steam Gage & Valve Co., Boston, Mass.

VARNISHES.
F. C. Reynolds, New York.

VARNISHES, ARMATURE.
Standard Paint Co., New York.

VENTILATORS.
Palmer Car Ventilator Co., Boston, Mass.
Pancoast Ventilator Co., Philadelphia, Pa.

VERTICAL AUTOMATIC ELECTRIC LIGHT ENGINES.
W. D. Forbes & Co., Hoboken, N. J.

VESTIBULES.
Gould Coupler Co., Buffalo, N. Y.

VISES.
Armstrong Bros. Tool Co., Cleveland, O.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.

VREELAND TRANSFER JACKS.
The Watson-Stillman Co., New York.

VULCABESTON AND TRAIN PIPE COVERING.
H. W. Johns Mfg. Co., New York.

WASHERS.
Boston Belting Co., Boston, Mass.

WATCH CASES.
Dueber Watch Works, Canton, O.

WATCHES.
Dueber Watch Works, Canton, O.
John J. McGrane, New York

WATER GAGES, AUTOMATIC SAFE.
Crosby Steam Gage & Valve Co., Boston, Mass.

WATER, GAS AND STEAM FITTERS' TOOLS.
Armstrong Mfg. Co., New York.

WATERPROOF CANVAS.
Standard Paint Co., New York.

WEIGHING MACHINES.
Pratt & Whitney Co., Hartford, Conn.

WHEEL PRESSES.
R. Dudgeon, New York.

WHISTLES.
Crosby Steam Gage & Valve Co., Boston, Mass
Star Brass Mfg. Co., Boston, Mass.

WIRE FENCES.
Cambria Iron Co., Philadelphia, Pa.
Page Woven Wire Fence Co., Adrian, Mich.

WIRE NAIL MACHINERY.
National Machinery Co., Tiffin, O.

WRENCHES.
Dayton Malleable Iron Co., Dayton, O.

WROUGHT IRON PIPE.
Allison Mfg. Co., Philadelphia Pa.

YACHT ENGINES.
W. D. Forbes & Co., Hoboken, N. J.

SECTIONAL VIEW.

Always use the

Pancoast

Latest Improved Car and Building

Ventilators.

Used by leading Railroads of the World, such as the Pennsylvania R.R. Great Northern and others of the United States.

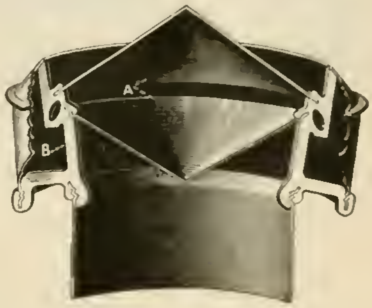
Absolutely Storm Proof.

It gives the best of Ventilation. Handsome appearance when applied to Buildings, Depots, Train Sheds, etc. The cost is small, but the satisfaction is great. The fact that **more Pancoast Ventilators are sold** each year is proof that true merit is appreciated We guarantee them. Made in all sizes, from two inches to seven feet. We guarantee to exhaust more cubic feet of air per minute than any other storm-proof ventilator made.

Strong. Handsome. Durable. Effective.

The Pancoast tested as above was a Single Deflector. It is now made with Double Deflector, whose efficiency will be nearly double that of the former, and superior to all others.

The Pancoast will exhaust more cubic feet of air per minute than any other storm-proof ventilator.



SHOWING EDGE-WISE BRACES.

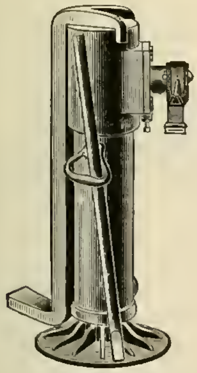
Manufactured and for sale by the

Pancoast Ventilator Company,

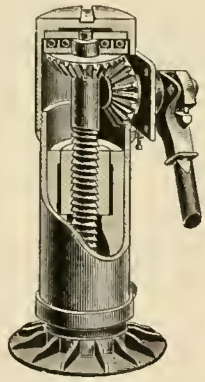
INCORPORATED,

MainOffice: 316 Bourse Building, Philadelphia, Pa.

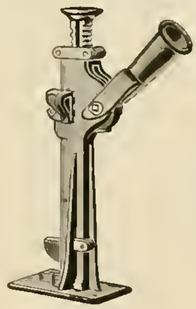
Foreign Office: 31 Westburn Terrace, Hyde Park, London, Eng.



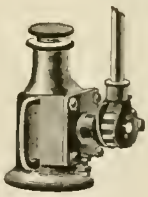
NORTON BALL-BEARING JACK WITH HOOK.



SECTIONAL VIEW NORTON BALL-BEARING JACK.



NORTON TRACK JACK.



NORTON JOURNAL JACK.

The Norton Ball-Bearing Jack.

The Norton Ball-Bearing Ratchet Screw Jacks are specially adapted to all classes of heavy Railway and Bridge service. The Ball Bearings reduce the friction and make the Jack more easily operated. The Jacks are perfectly safe, and always reliable; working parts are fully protected from grit and rust, and the Jacks may be used in any position, or applied to traversing bases. The cheapest, lightest and best Jack made.

Superior to the Hydraulic. No expense for alcohol or packings, and no valves to give out or leak. In use on many of the leading American railroads, and fully guaranteed by the manufacturer.

Catalogue contains cuts and descriptions of Jacks for all classes of service from 8 to 70 tons capacity, also the best Track Jack on the market.

Special inducements are offered for export, and highest references given.

Full Information from the Manufacturer, **A. O. Norton,**

336 Congress Street, Boston, Mass., U. S. A.

Guaranteed for Ten Years.

P. & B. Ruberoid Car Roofing.

Will not split and tear. No paper—made of hair felt—water and acid proof.

▪▪▪

P. & B. Ruberoid Roofing.

For roundhouses, car sheds, repair shops, station buildings and for any structure requiring a durable, water, acid, alkali and coal-gas proof covering.

▪▪▪

P. & B. Waterproof Papers.

In use by prominent railroad and steamship companies for insulating dairy, fruit and refrigerator cars and cold storage rooms.

Free from tar, odorless and air tight.

▪▪▪

The Standard Paint Co., Manufacturers,

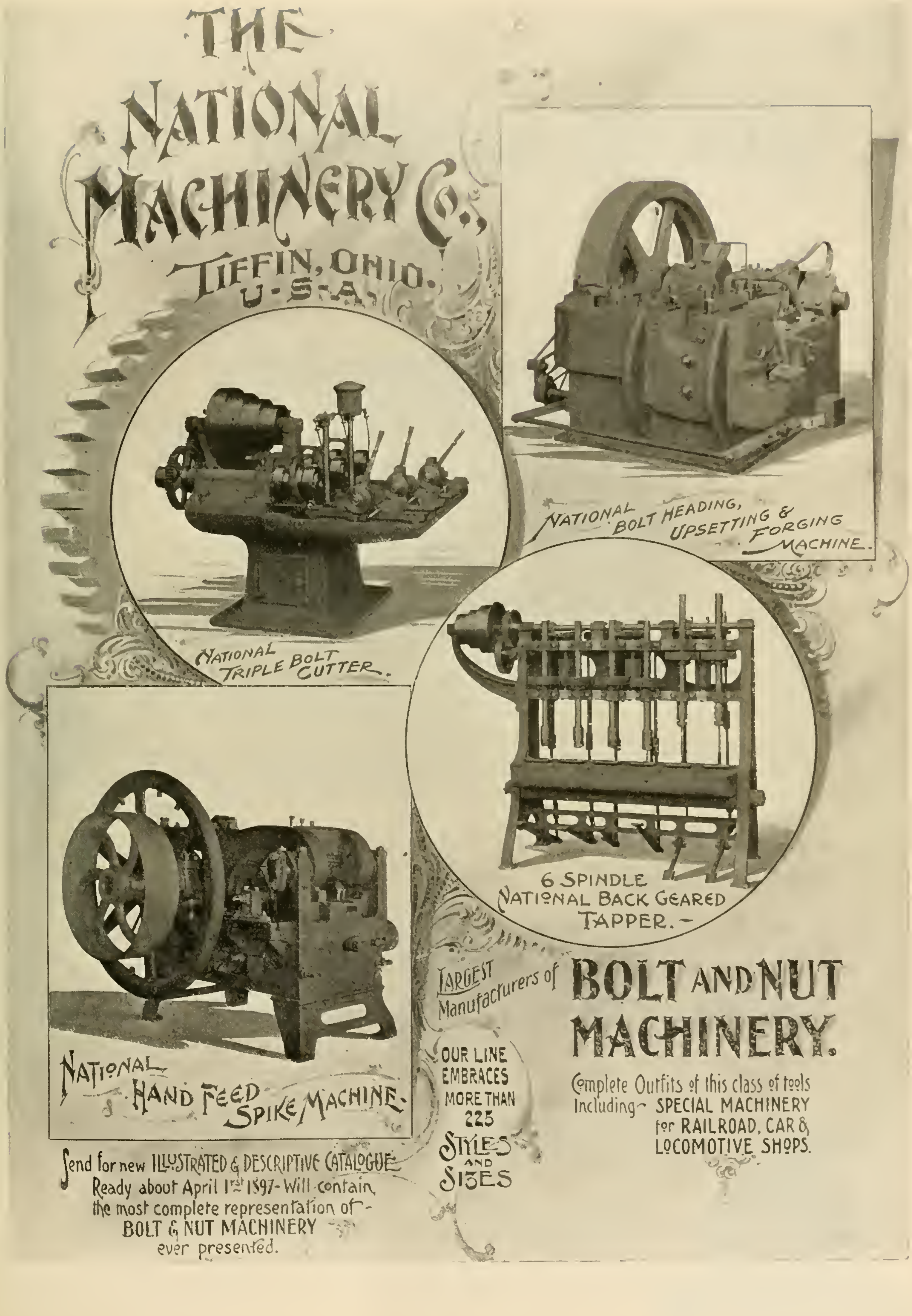
81-83 John St., NEW YORK.

CHICAGO: 189 Fifth Avenue.

....WRITE FOR INFORMATION AND SAMPLES....

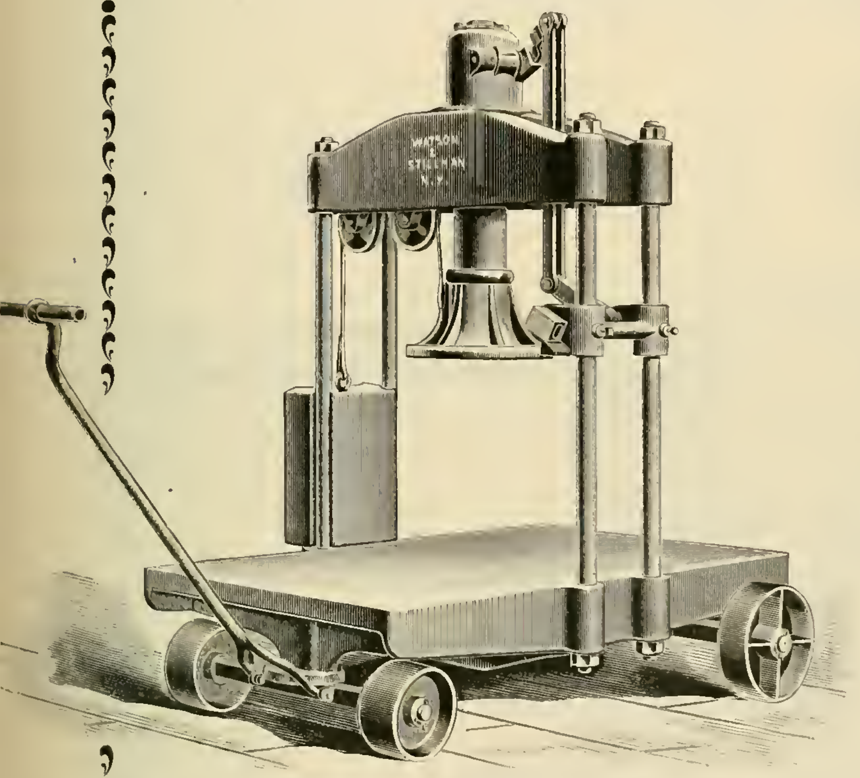
Registered.

Registered.


THE NATIONAL MACHINERY CO.,
TIFFIN, OHIO. U-S-A.
NATIONAL BOLT HEADING, UPSETTING & FORGING MACHINE.
NATIONAL TRIPLE BOLT CUTTER.
6 SPINDLE NATIONAL BACK GEARED TAPPER.
NATIONAL HAND FEED SPIKE MACHINE.
LARGEST Manufacturers of BOLT AND NUT MACHINERY.
Complete Outfits of this class of tools Including~ SPECIAL MACHINERY for RAILROAD, CAR & LOCOMOTIVE SHOPS.
OUR LINE EMBRACES MORE THAN 225 STYLES AND SIZES
Send for new ILLUSTRATED & DESCRIPTIVE CATALOGUE
Ready about April 1st 1897- Will contain
the most complete representation of-
BOLT & NUT MACHINERY
ever presented.

An Established Reputation

as Jack Makers for many years is the foundation of our business. We have made and sold to the best railroads of America, some thousands of jacks that in everyday service have proven the quality and character of our work. We use wrought steel and steel castings in all our jacks—great strength for less weight. We have patterns and carry in stock more than 200 varieties of jacks alone—anything and everything in the jack line.



Of course, in such a works as ours, building hydraulic machinery, great and small, tools for railroad work form a large part of the output.

We make a great variety of wheel presses. The Vreeland transfer jack — for taking wheels out from under engines without a drop pit. Crank-pin presses, punches, shears, straighteners, and dozens of other hydraulic tools.

The large illustration here shown explains the construction of a very cheap and useful press, made especially for railroad shop work. It was originally designed to press in and out driving-box brasses, and is particularly handy and efficient in this kind of work.

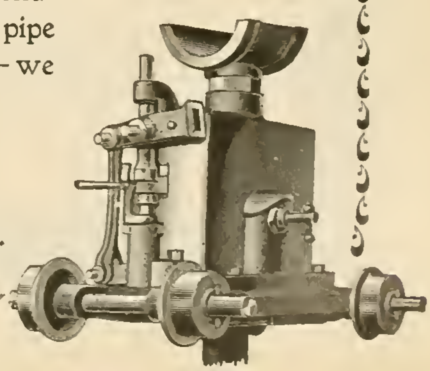
The cylinder or base of jack is counterweighted, the lever connection is lowered on frame for ease in working, and the lower platen is true. There is a four-inch hole in lower platen, not shown in cut, which can be used for forcing work through; a plug fills the hole when not in use.

Lower platen is 30″ x 48,″ movement of ram 12,″ takes work 18″ in height. An ideal press for driving brass, rod bush, and such work. No other straightening device or press needed in a railroad shop where one of these presses is in use. You take it to the work instead of taking the work to it.

Catalogues sent on application. State line of work; no use sending you catalogues of hydraulic fish presses or 600 ton lead pipe presses, when you want a die sinker's press or a pulling jack — we have them all.

The Watson-Stillman Co., 202 E. 43d St., New York.

Catalogue "N" tells the story for R. R. men.



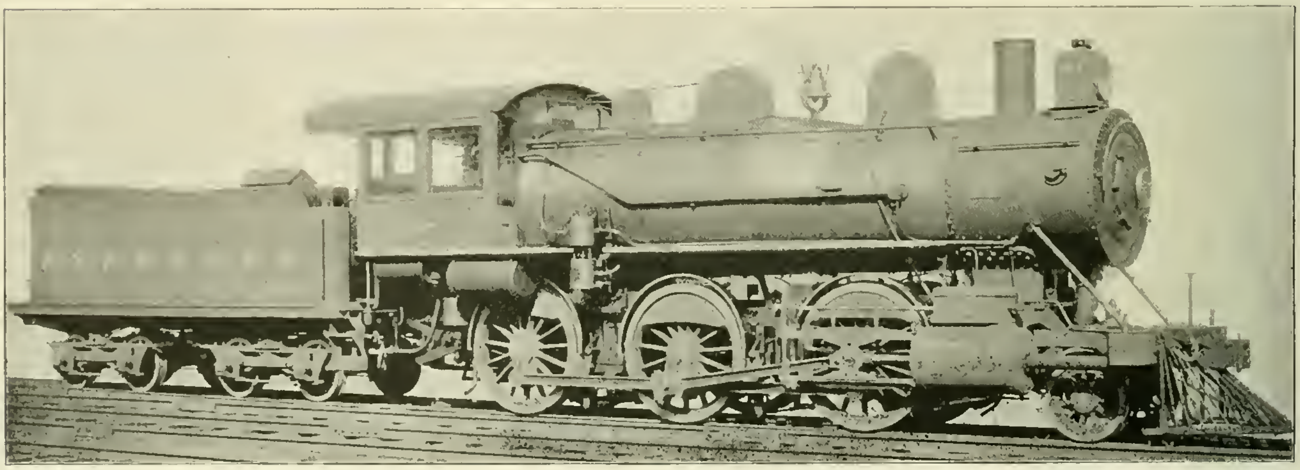
Established 1848.

Schenectady Locomotive Works,

Schenectady, N. Y.

Annual Capacity, 450.

Edward Ellis, Pres. Wm. D. Ellis, Vice-Pres. and Treas. A. J. Pitkin, Supt. A. P. Strong, Secy.

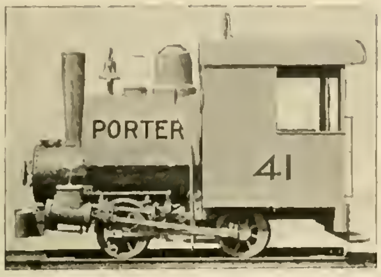


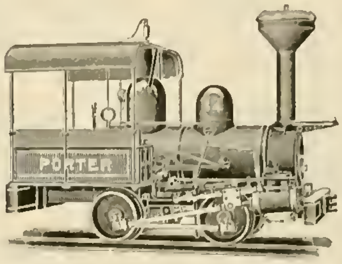
Makers of

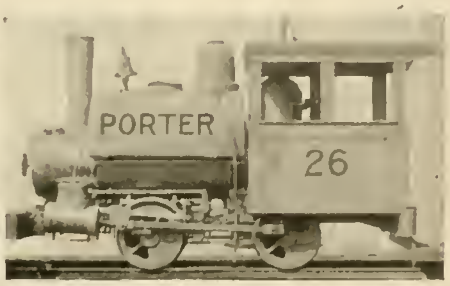
Locomotives of Standard Design for all classes of service, or from designs furnished by Railroad Companies.

Compound Locomotives

Showing an Economy of from 15% to 30% in Fuel and Water.



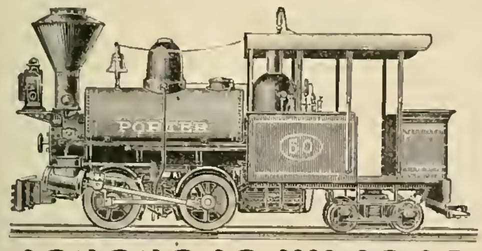




H. K. Porter & Co., Pittsburgh, Pa.

Locomotives of all designs and gauges of track, steam, compressed air and electric, 4 to 40 tons weight, including Locomotives for freight and passenger and yard service; Industrial Railways, Street Railways, Plantations, Steel Works, Blast Furnaces, Iron Mills, Quarries, Coal Mines, Iron, Copper, Silver and Gold Mines, Phosphate Works, Contractors' Service, Logging Roads, etc.

All work to duplicate system and duplicate parts on hand in stock. Compressed Air Locomotives for Underground Work, Powder Mills, Textile Manufacturers, Cotton Warehouses. Locomotives, wide and narrow gauge, always on hand, completed. Our Locomotives have been exported to Canada, Mexico, Cuba, Porto Rico, San Domingo, Colombia, Venezuela, Guiana, Brazil, Argentine, Uruguay, Chili, Peru, Ecuador, Hawaii, Japan, Russia, and South Africa.



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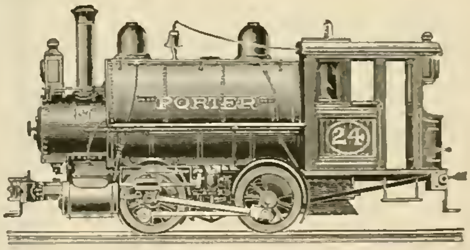

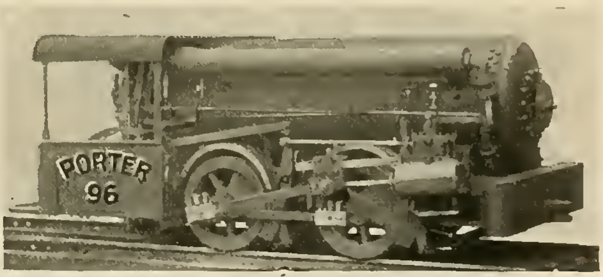

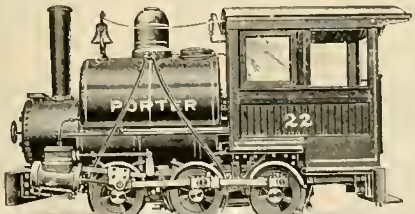

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Cash must accompany order. No books sent C. O. D. Give name of book and author, and we can furnish any book wanted. The list below is especially recommended for mechanical readers. All books sent by mail free for price named, unless otherwise stated.

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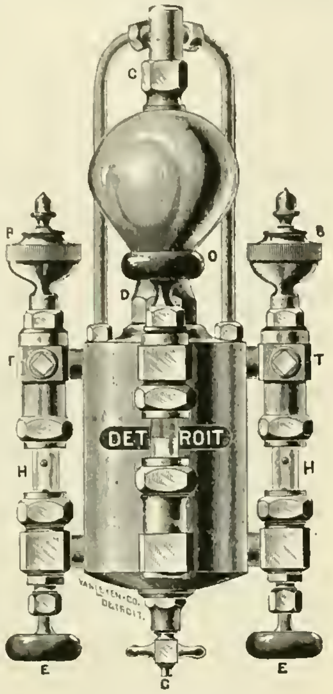

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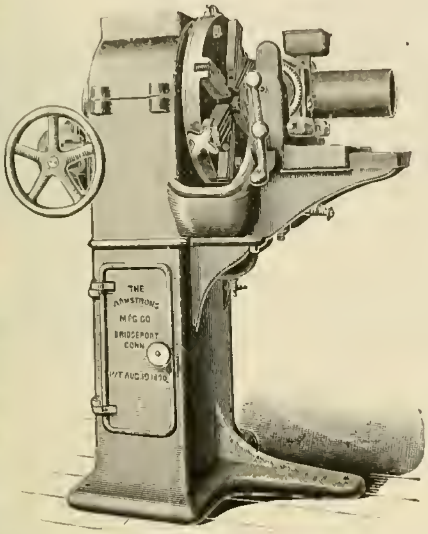

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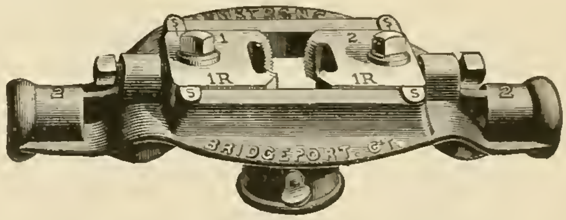

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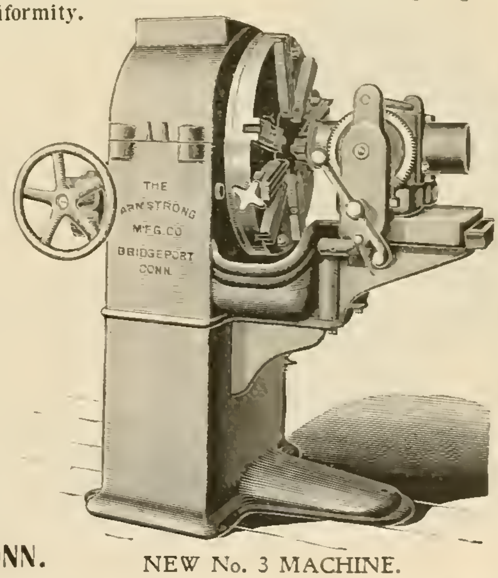

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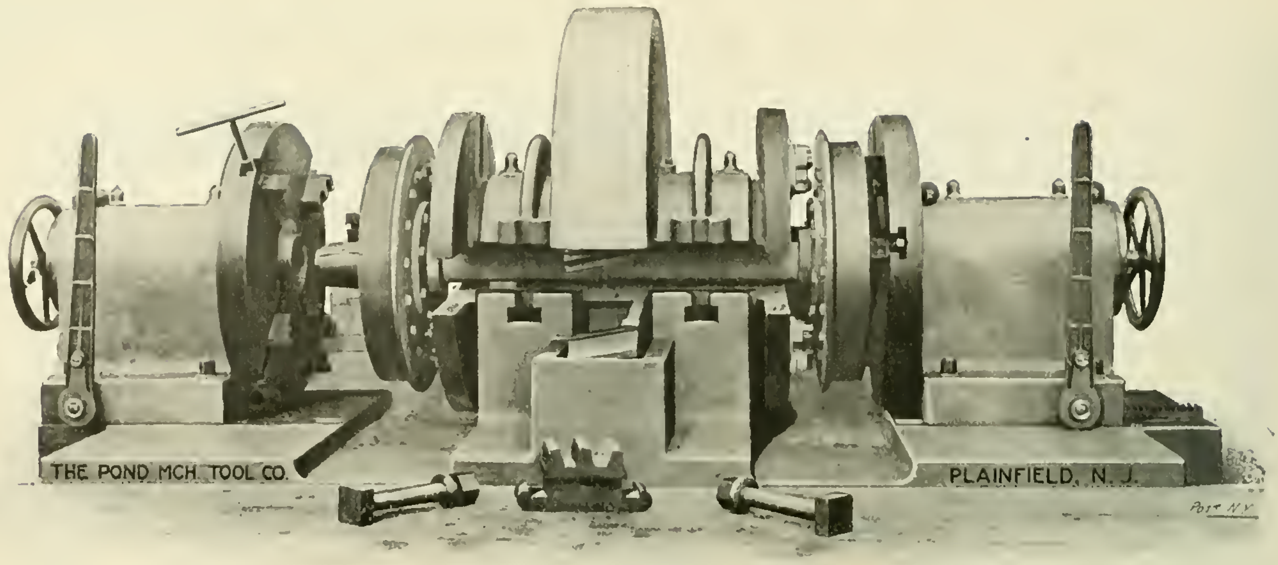

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One Pair 38 inch.	5.30 p. m.	7.00 a. m.	1 hour 30 minutes.
" " "	7.00 a. m.	8.20 a. m.	1 hour 20 minutes.
" " "	8.20 a m.	9.30 a. m.	1 hour 10 minutes.
" " "	9.30 a. m	11.25 a. m.	1 hour 55 minutes.
" " "	11 25 a. m	1 42 p. m	1 hour 32 minutes.
" " "	1.42 p. m.	3.18 p. m	1 hour 36 minutes.
" " "	3 18 p. m.	4.50 p. m.	1 hour 32 minutes.

Seven pairs, - - - - 10 hours 35 minutes.

Average time consumed per pair in turning, 1 hour 30 minutes. The last four pairs turned were harder than the average wheel.

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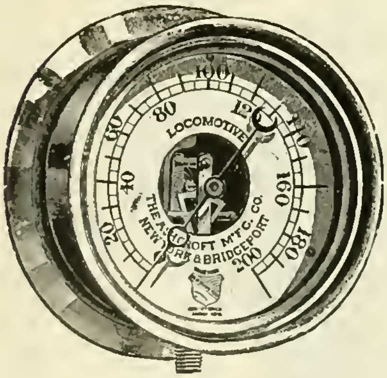

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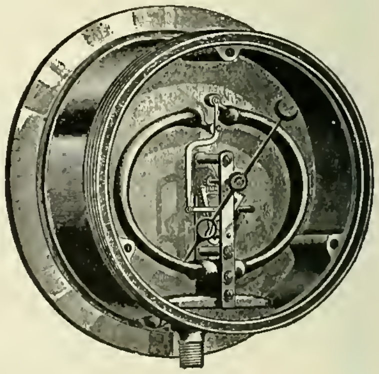

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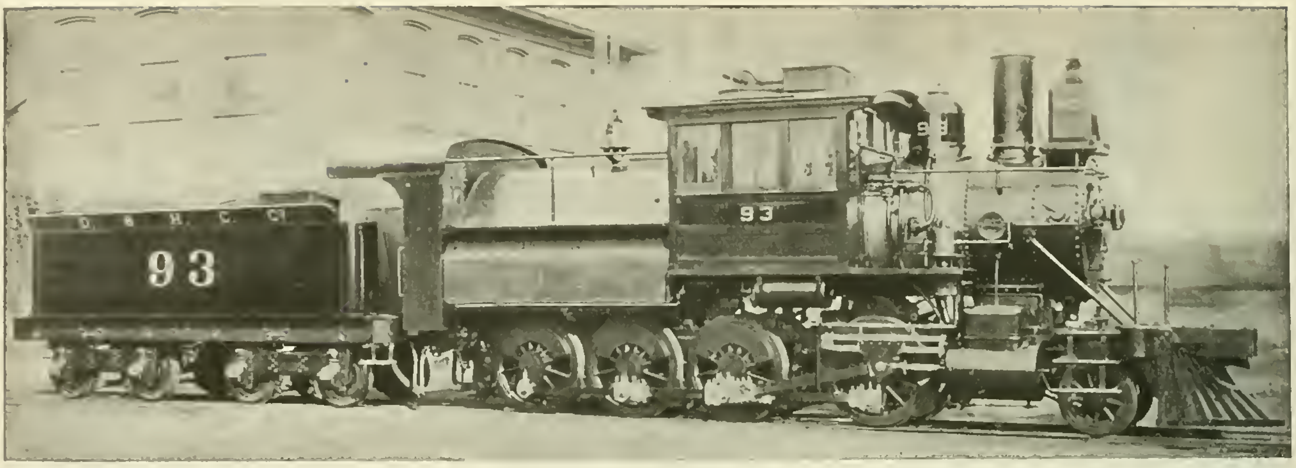
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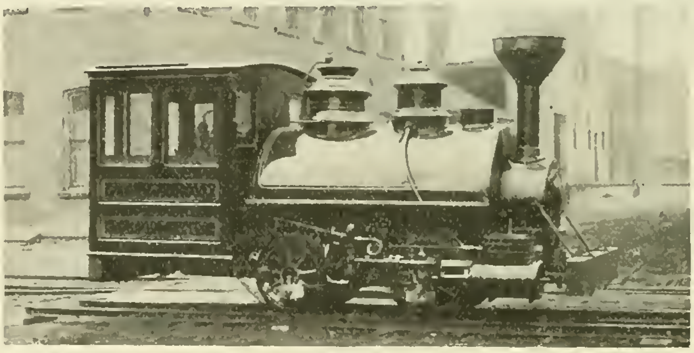

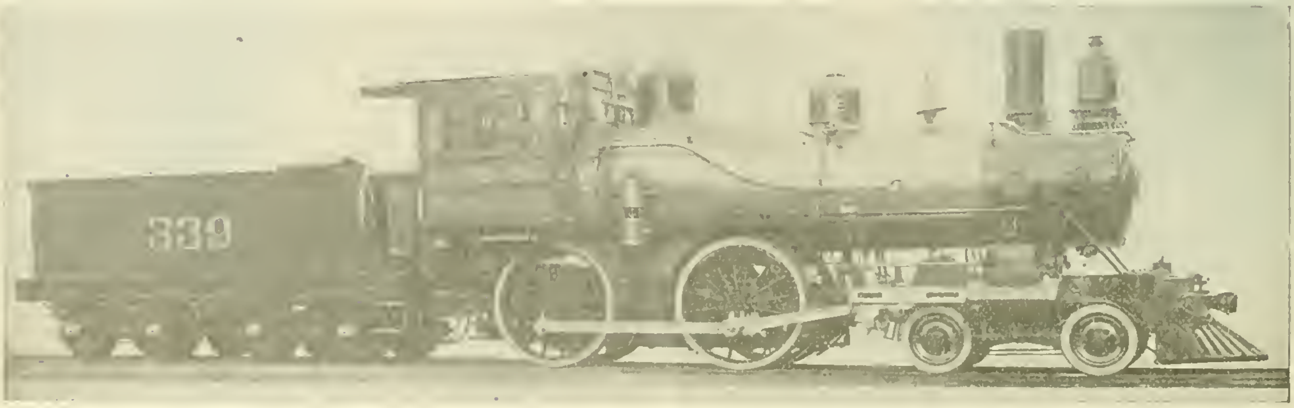
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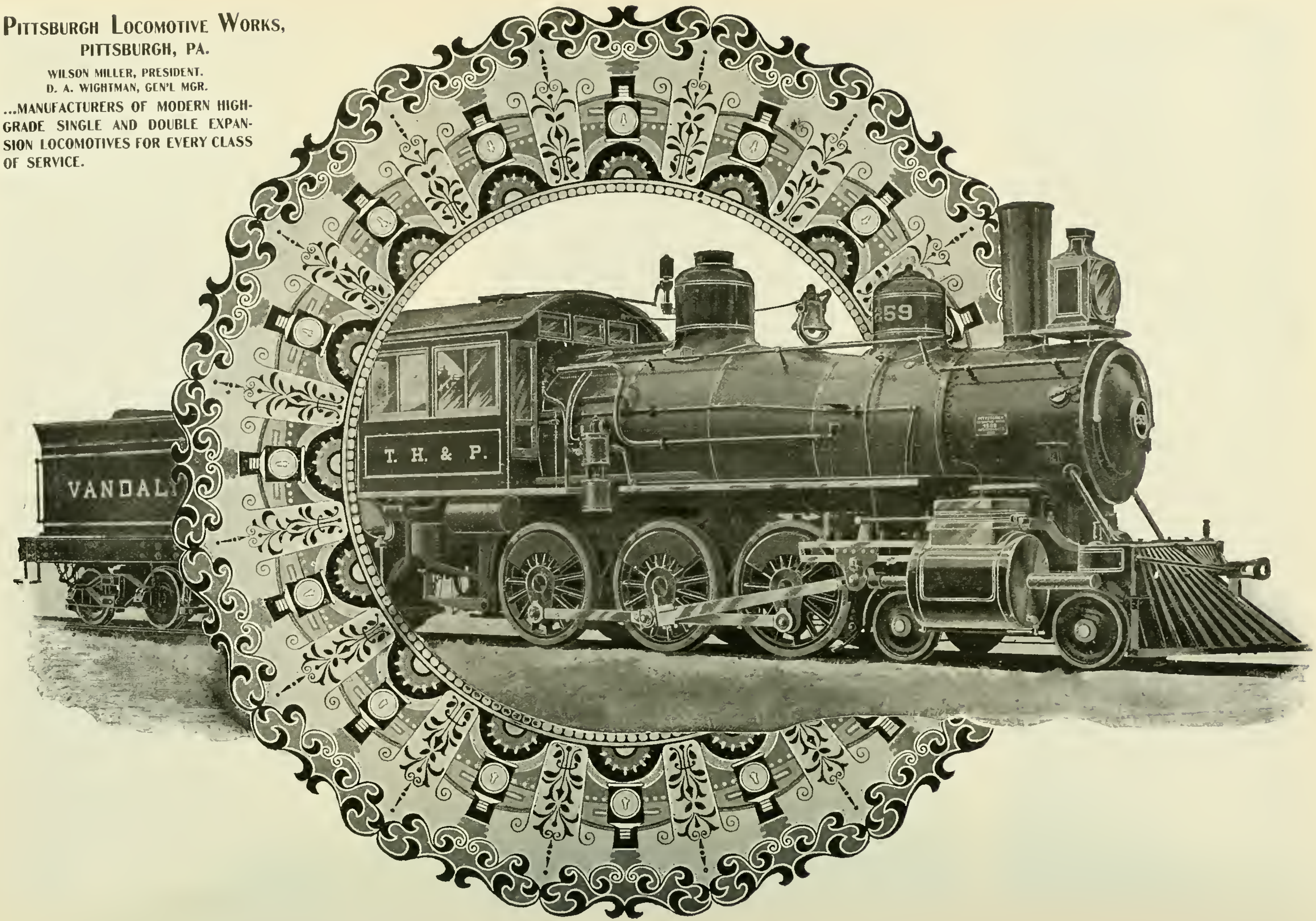
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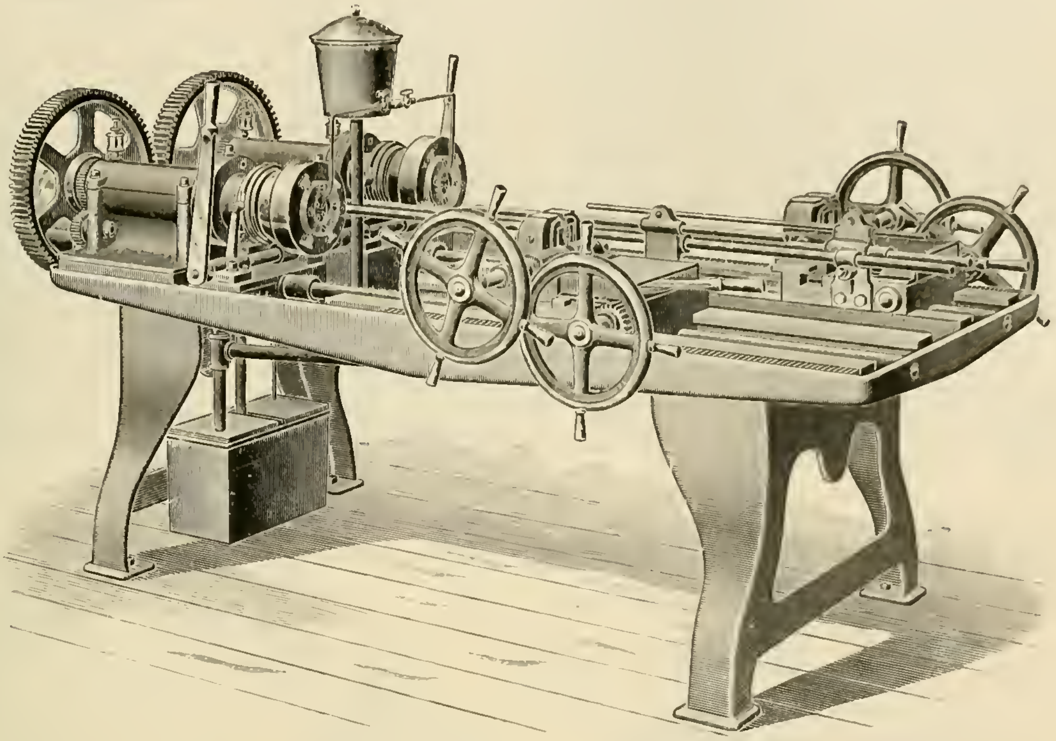

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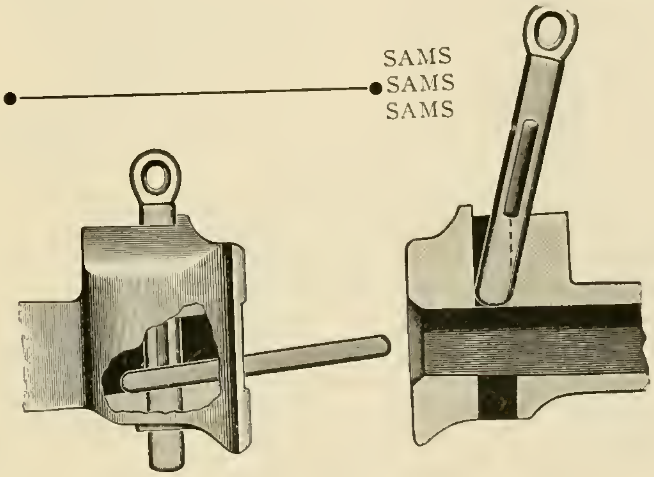

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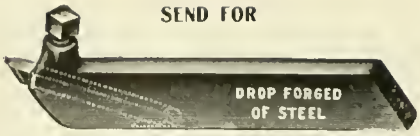

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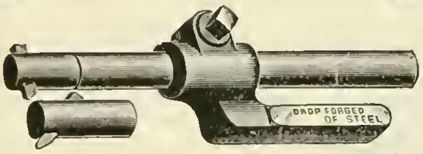

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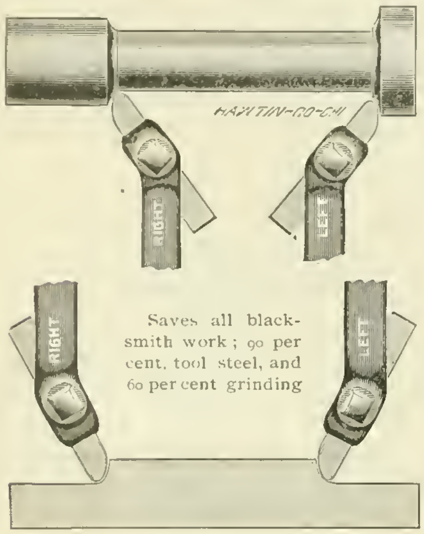

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Mr. Railway Official:

Dear Sir:—Please send tracer after the following, at once:

On June 1, 1896, we shipped to the Lake Shore & Michigan Southern Railway, care E. Elden, M. M., Buffalo, N. Y.:

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" " 3 Left " " "
" " 7 " " " "
" " 7 Right " " "

On November 1st, to L. S. & M. S. Ry., to J. O. Bradeen, Norwalk, O.:

Two No. 6 Straight Tool Holders
One " 6 Right Offset Tool Holder.
" " 6 Left " " "

On November 1st, to L. S. & M. S. Ry., to E. Elden, Buffalo, N. Y.:

One No. 2 Armstrong Tool Holder.
" " 3 " " "

On December 1st, to L. S. & M. S. Ry., to A. A. Bradeen, Cleveland, O.:

One No. 6 Straight Tool Holder.

On December 1st, to L. S. & M. S. Ry., to W. L. Gilmore, Elkhart, Ind.:

One No. 1 Right Offset Tool Holder.
" " 3 " " " "
" " 5 " " " "
Two " 3 Left " " "
" " 4 " " " "
One " 5 " " " "
" " 1 " " " "
" " 1 Straight " " "
" " 3 " " " "
" " 6 " " " "

On December 11th, to L. S. & M. S. Ry., to J. O. Bradeen, Norwalk, O.:

Two No. 8 Boring Tools.
" " 9 " "
Three " 11 " "

Although many of the above tools were sent subject to approval not one has been returned to us.

The following letter we think will show the reason why it is that the foremen and workmen take to the Armstrong Tool Holder:

Norwalk, O., Dec. 7, 1896.

Armstrong Bros. Tool Co., Chicago:

Gentlemen: Through the courtesy of Mr. R. H. Kennedy, General Foreman of the Lake Shore Shops in this city, we have had our attention called to the advantages of your Tool Holders and System. We have looked over the pamphlet-catalog and have decided to place an order as follows:

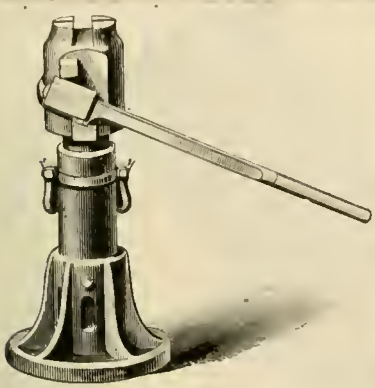
Two No. 1, One No. 2, One No. 3 Staight Armstrong Tool Holders.
" " 1 Right Offset Armstrong Tool Holders.
" " 1 Left " " " "
One " 9 Armstrong Boring Tool.
" " 11 " " "

Hoping to receive prompt service, which we will reciprocate, we are, yours truly,

NORWALK FOUNDRY & MACHINE CO.,
A. W. SIDWELL, Secretary.

WE WANT TO SEND EVERY RAILWAY MASTER MECHANIC A SET OF THESE TOOLS ON 30 DAYS' TRIAL.

Not the Lowest Priced, but Cheapest in the End.



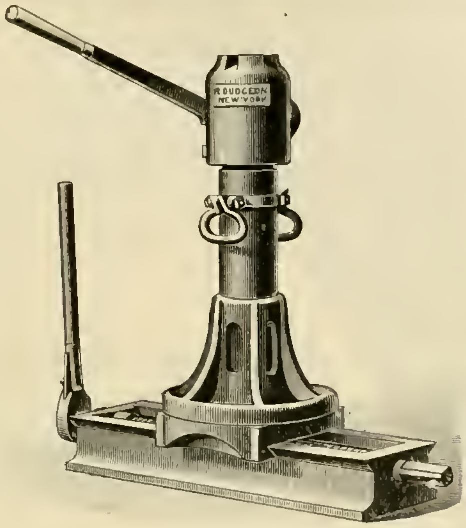
BASE JACK.

When ordering Hydraulic Jacks, Punches, Roller Tube Expanders, specify

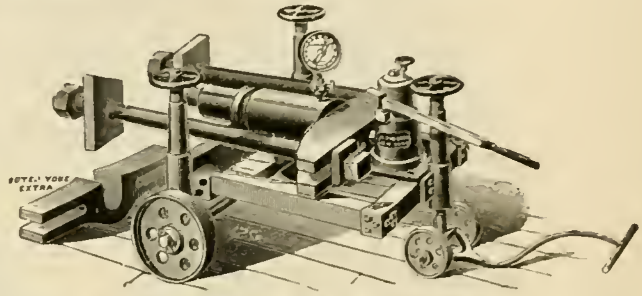
Dudgeon's Latest Improved

Patents on the Hydraulic Jack.

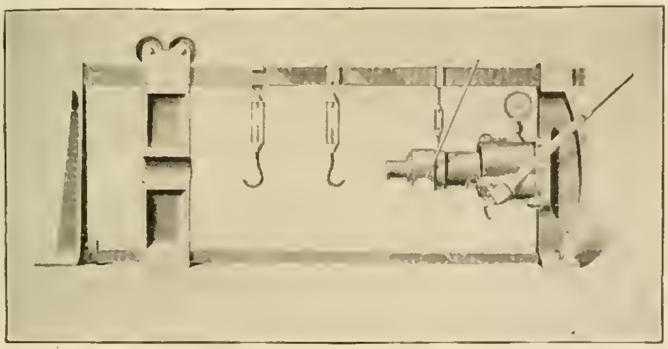
July 8, 1851.
Aug. 1, 1865.
April 15, 1873.
Feb. 2, 1882.
Jan. 23, 1883.
May 6, 1884.
Nov. 17, 1885.
Nov. 17, 1885.
Jan. 12, 1886.
Sept. 13, 1887.
Sept. 13, 1887.
July 5, 1892.



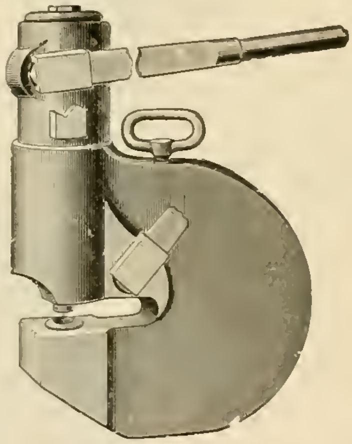
TRAVERSING JACK.



ELEVATING HYDRAULIC CRANK PIN AND SMALL WHEEL PRESS.



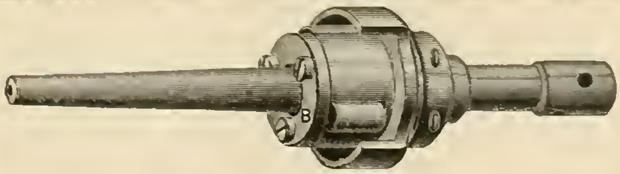
SMALL WHEEL PRESS.



HYDRAULIC HEAD PUNCH

All correspondence will receive prompt and careful attention.

Original inventor, Patentee and Manufacturer of the Hydraulic Jack, and Controller of all Patents.



IMPROVED TUBE EXPANDER.

Wheel Presses and Direct Acting Steam Hammers

Richard Dudgeon, 24-26 Columbia St., New York City.


UTICA

"Utica Steam Gauges stand for all that's best in gauges, and carry a guarantee that guarantees.

Utica Steam Gauge Company,

70-72 Fayette Street,

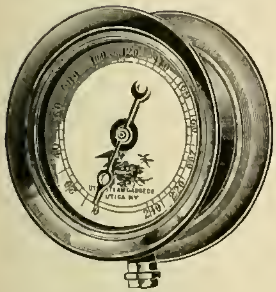
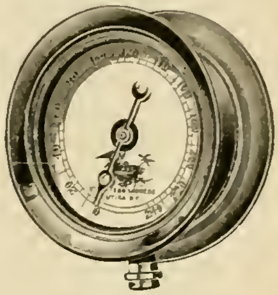
Utica, N. Y.

UTICA UTICA

Utica Locomotive Gauge, No. 6.
Utica Cab Gauge for Heating, No. 3.
Utica Air Brake Gauge.

☞ "Our famous Watch Chain Steam Gauge" sent on receipt of eight 2c. stamps.

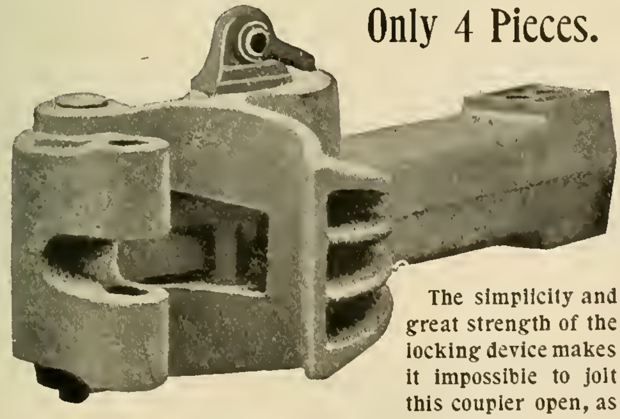
UTICA

The "Smillie"

M. C. B. Coupler

Only 4 Pieces.



The simplicity and great strength of the locking device makes it impossible to jolt this coupler open, as the locking pin must be raised 5 inches before the knuckle is released. The S shaped knuckle with locking pin forms a double lock which will draw any train even if pivot pin is lost.

TRADE
COUPLES BY SLOW IMPACT.
MARK.

The Smillie Coupler and Manu'fg Co.,

Office and Works:

91 Clay St., Newark. New York, 39 Cortlandt St.

S. J. Meeker,

Malleable,
Grey Iron &
Brass

Foundries.

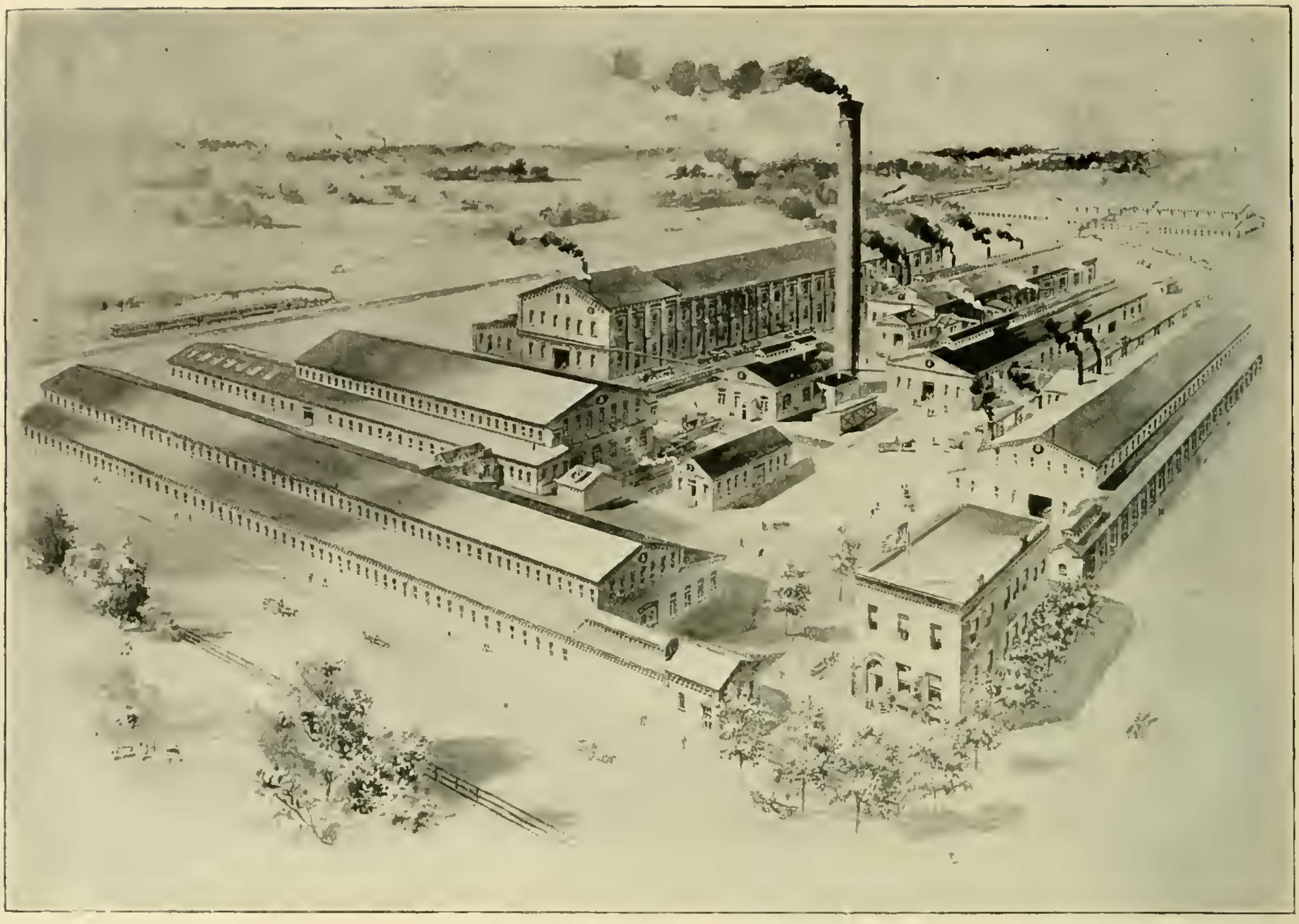
Received Highest Award at World's Columbian Exposition.

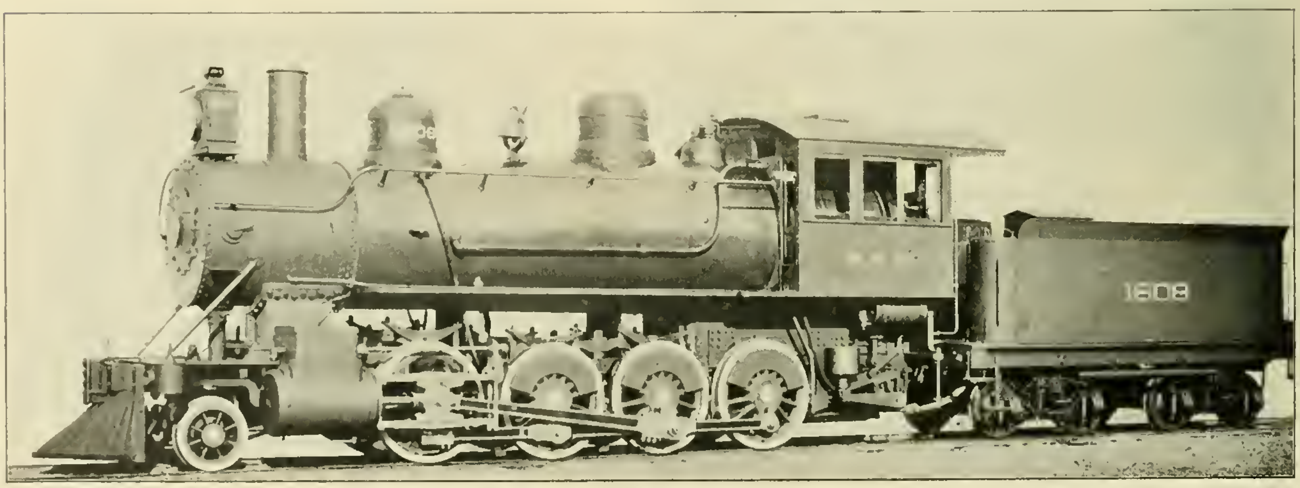
Refined Malleable Castings made from Air Furnace and Cupola.
RAILROAD WORK a specialty.

--- Correspondence Solicited.

Clay, Spring and Ogden Streets,

Newark, N. J.




1608

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. X. NEW YORK, FEBRUARY, 1897. No. 2.

New Passenger Locomotives for the New York Central & Hudson River Railroad.

The accompanying cut, from photograph of engine 928, and specification, illustrate and describe one of a lot of eight-wheel passenger locomotives recently built by the Schenectady Locomotive Works for the New York Central & Hudson River Railroad Company.

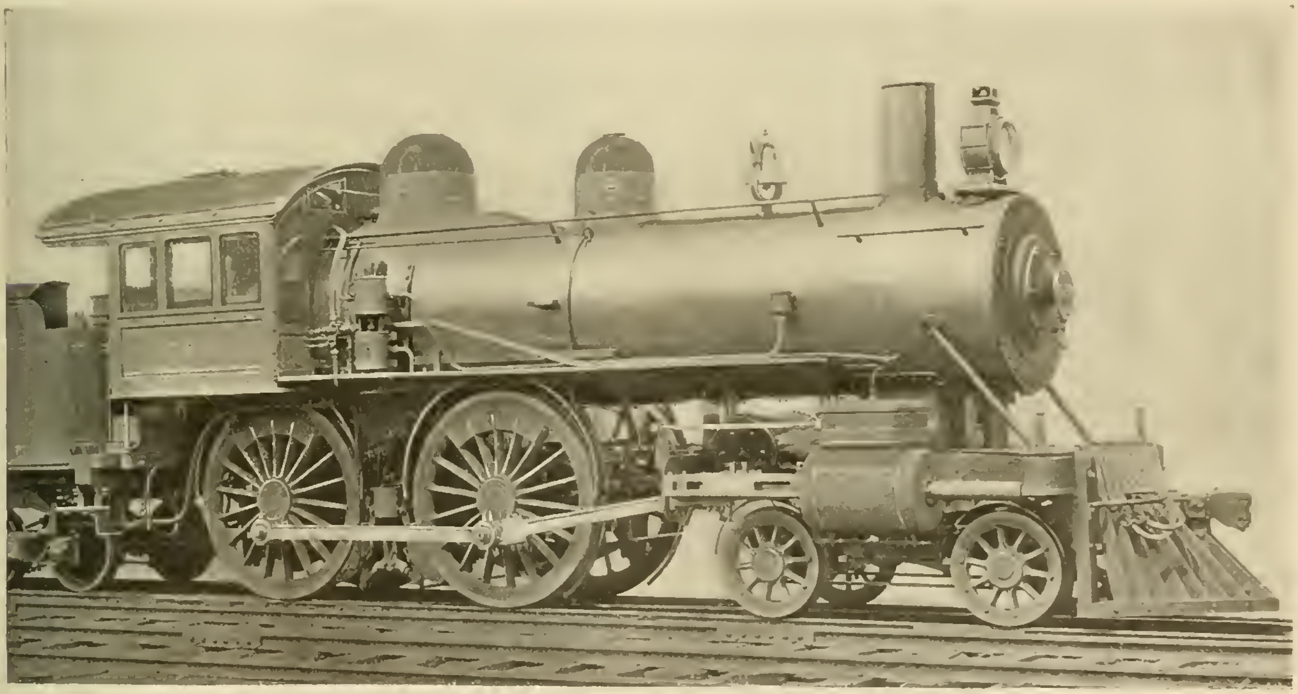
The engines were built to specifications and drawings prepared by Mr. Wm. Buchanan, superintendent of motive power and rolling stock of the New York Central & Hudson River Railroad, and though somewhat similar to those previously designed by Mr. Buchanan, and which are rendering such efficient service, possess many features of marked improvement.

As will be seen from the specification, the boilers of the new engines have a very large heating and grate surface—a very important feature in fast heavy traffic, and one which Mr. Buchanan has always advocated. The driving and truck journals are of very large size, while the driving boxes are of solid magnus metal. The driving wheels are cast of gun iron. The piston rods are extended through front cylinder heads—a practice which has been found very advantageous by Mr. Buchanan—reducing to a minimum the trouble with wear of cylinders and broken piston rods.

There were ten engines in the above lot, five of which had drivers 78 inches, as shown by cut and specification, while five were duplicates, excepting having drivers 70 inches diameter.

All these engines are in fast service on the celebrated "Empire State Express," the Fast Mail, and the Chicago, St. Louis & Cincinnati Limited trains, and have already made some exceptionally fast time on these trains.

On December 1st one of the engines, No. 924, made the run with train No. 50—the "Empire State Express," east—from Syracuse to Albany, a distance of 147.84 miles, in two hours and thirty minutes, including a three-minute stop at Utica, together with a slow-down going through Schenectady and a slow-down going through the streets of Syracuse, a distance of about 1½ miles, in compliance with that city's ordinance limiting the speed to eight miles per hour. Deducting ten minutes for the time in running the 1½ miles in Syracuse and three minutes' stop at Utica, leaves the running time from the city limit of Syracuse to Albany two hours and seventeen minutes. Deducting the 1½ miles in Syracuse from the total distance leaves 146.34 miles, which made a speed of sixty-four miles per hour for the 146.34 miles, not allowing for slow-down through Schenectady.



BUCHANAN'S LATEST FLYER.

GENERAL DIMENSIONS.

The following are a few of the leading particulars about the engine:

Weight in working order—130,000 pounds.

Weight on drivers—90,000 pounds.

Wheel base, driving—8 feet 6 inches.

Wheel base, rigid—8 feet 6 inches.

Wheel base, total—23 feet 11 inches.

CYLINDERS.

Diameter of cylinders—19 inches.

Stroke of piston—24 inches.

Kind of piston packing—3-ring, cast iron.

Kind of piston rod packing—U. S. metallic.

Size of steam ports—18 inches by 1¼ inches.

Size of exhaust ports—18 inches by 2¾ inches.

Thickness of bridges—1⅛ inches.

VALVES.

Kind of slide valves—Richardson balanced.

Greatest travel of slide valves—5½ inches.

Outside lap of slide valves—1 inch.

Inside lap of slide valves—Line and line.

Lead of valves in full gear—1-16 inch.

Kind of valve stem packing—U. S. metallic.

WHEELS, ETC.

Diameter of driving wheels outside of tire—78 inches.

Material of driving wheels, centers—Gun iron.

Diameter and length of driving journals (material hammered iron)—9 inches diameter by 12½ inches.

Diameter and length of main crank pin journals (crank pins hammered iron)—5½ inches diameter by 5½ inches.

Diameter and length of side rod crank pin journals (rods steel)—4½ inches diameter by 3½ inches.

Engine truck, kind—4-wheel, rigid center, with spring side bearings.

Engine truck journals (axles iron)—6¼ inches diameter by 10¼ inches.

Diameter of engine truck wheels—36 inches.

Kind of engine truck wheels—Krupp No. 3, with O. H. tire 2⅝ inches thick, held by retaining rings.

BOILER.

Style—Wagon top.

Outside diameter of first ring (smoke-box jacketed)—60 inches.

Working pressure—190 pounds

Material of barrel and outside of fire-box—Carbon steel.

Thickness of plates in barrel and outside of firebox—Throat, ⅝ inch; balance, 9-16 inch.

Horizontal seams—Butt joint, sextuple riveted, with welt strip inside and outside.

Circumferential seams—Double riveted.

Firebox, length—108⅛ inches.

Firebox, width—40⅞ inches.

Firebox, depth—Front, 74½ inches; back, 58½ inches.

Firebox, material—Carbon steel.

Firebox plates, thickness—Sides, 5-16 inch; back, 5-16 inch; crown, ⅜ inch; tube sheet, 9-16 inch.

Firebox, water space—4 inches front, 3 inches sides, 3 to 4½ inches back.

Firebox, crown staying—5 x ¾-inch crown bars, welded at ends.

Firebox, stay bolts—Brown & Co.'s U. S. iron, ⅞ inch and 1 inch diameter.

Tubes, material—Charcoal iron, No. 11, W. G.

Tubes, number—288.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—12 feet 1⅛ inches.

Fire brick supported on—Water tubes.

Heating surface, tubes—1,809.56 square feet.

Heating surface, water tubes—12.93 square feet.

Heating surface, firebox—158.23 square feet.

Heating surface, total—1,980.72 square feet.

Grate surface—30.69 square feet.

Exhaust pipes—Double.

Exhaust nozzles—3¼ diameter.

Smoke stack, inside diameter—16 inches.

Smoke stack, top above rail—14 feet 8 inches.

Boiler supplied by—Two monitor injectors, No. 10 R. S., No. 9 L. S.

TENDER.

Weight, empty—43,220 pounds.

Wheels, number of—8.

Wheels, kind—Krupp No. 4, with O. H. tire 2⅝ inches thick, held by retaining rings.

Wheels, diameter—36 inches.

Journals, diameter and length (axles iron)—4½ inches diameter by 8 inches.

Wheel base—15 feet 10½ inches.

Tender frame—6½ x 4 x ¾-inch angle iron.

Tender trucks—Railroad company's style, wood bolster, side bearing, front and back.

Water capacity—4,500 U. S. gallons.

Coal capacity—17,000 pounds (8½ tons).

Total wheel base of engine and tender—48 feet 9½ inches.

Total length of engine and tender—58 feet 4⅜ inches.

Engine equipped with: Double-riveted mud ring; two 3-inch consolidated muffled safety valves; Westinghouse automatic air brake on drivers, tender, and for train; Westinghouse air signal; 9½-inch air pump; asbestos cement boiler lagging; Gould pilot and long-shank tender coupler; water scoop on tender; piston rods extended through front cylinder heads; Nathan No. 9 triple-sight feed lubricator; springs made by Schenectady Locomotive Works; round case headlight; American steel brake beams on tender; Ross-Meehan shoes.

An improved form of boiler check has been patented by Mr. Chas. Linstrom, master mechanic of the Yazoo & Mississippi Valley Railroad at Vicksburg, Miss. It consists essentially of a check valve, having an extended stem, to which is attached a spring that holds the valve to its seat and can be adjusted by means of a nut to any tension which may be desirable. This will prevent checks sticking off the seat.

Russian Railways.

BY W. J. M'CARROLL.

I do not remember ever reading any detailed account of the railroads in Russia, and thinking it might be interesting to the many readers of "Locomotive Engineering" to hear something of this country, I will therefore attempt to give a description of the right of way, track, locomotives, cars, etc. In the first place it may be well to form some comparison, by size to the United States, as to area in square miles, population, miles of railroad and miles of telegraph lines.

Russia in Europe and Asia has a population of 112,976,900; area in square miles, 8,457,289; number of miles of railroad, about 23,000; number of miles of telegraph lines, 105,000. Population of the United States, 62,622,250; area in square miles, 3,581,885; number of miles of railroad, 181,000. . . By this comparison it will be seen that the United States has 50,345,750 less population, and is 4,875,-404 square miles less in area. But the United States has 158,000 miles more of railroads.

Railroad building for a number of years was practically at a standstill, and was mostly owned and controlled by private companies. In 1890 and 1891 the government began to assume control of all the railroads, and now, with a few exceptions, all are under government control. There is at present nearly 10,000 miles of road under construction.

TRACK AND RIGHT OF WAY.

The oldest line in Russia is between St. Petersburg and Moscow. It is 609 versts long (403 miles) and is known as the Nicholas Railroad, so called after Emperor Nicholas, who gave consent to build the line, and decided on the route by taking a ruler and drawing a straight line on the map between St. Petersburg and Moscow. It has been in operation fifty-one years. It is the only all double-track line. The country through which it passes is mostly flat and uninteresting.

The right of way of all lines is kept perfectly clear of trees and brush, ditches kept clean, banks well sodded. The lines in general in the north and interior are practically straight and level, while in the southern section they have many heavy grades and sharp curves. The bridges are overhead girder style, and from appearance are unusually strong, from the size of girders and truss rods. Many of the wooden bridges are being replaced by stone arches. The rails are of the American pattern; 30 feet long, 56 and 66 pounds per yard. Gage of track, 5 feet. Rails jointed together by angle-bar fish plates, with four ⅞-inch bolts. Cross-ties are 6 to 8 inches thick, 10 inch face, and 9 feet long. Rails fastened to ties by T-head spikes and lag screws, some few tie plates being used. Rails laid with even joints. Ties spaced 30 to 40 inches, center to center. Spring rail frogs and split switches are in general use.

BUILDING BRIDGE OF ROUND TIMBER.

BRIDGE AT RECHETA, NEAR KANSK, CENTRAL SIBERIA.

RUSSIAN-BUILT WOOD-BURNER AT WORK.

CEMENT WORKS BUILT BY RUSSIAN GOVERNMENT. ETAPE FOR RECEIVING PRISONERS ON RIGHT.

SCENES ON SIBERIAN RAILWAY.

From Lodian, Tomsk, Western Siberia.

All along the line one will see sign boards indicating the change of grade. The posts are 10 feet high and have two arms on top. One arm is marked for the variation of grade, while the other is marked for the distance of the variation. When the track is level, the variation board is in a horizontal position and marked zero, and the distance board marked the number of feet level. Then, if the grade is descending, the variation board will be inclined downward at an angle of 15 degrees and marked 1.8 in 212, indicating a down grade of 1.8 feet in 212 feet, and so on if the grade is ascending.

Not too much could be said in favor of the general appearance of the track, as it is mostly all stone and gravel ballast, some places 3 feet thick. The edging of ballast is very accurately laid in a straight line by women and children. The clearing from edge of ballast to ditch or edge of bank is in many places kept swept clean. While the appearance of the track is so good, it cannot be classed as good riding track, on account of the ties being placed so far apart and the rails light.

The stations and office buildings are of brick or stone, large and commodious, with unusually long and wide platforms. Around each station will be found a fine garden, some as large as 5 and 6 acres. Through the gardens they have nice walks, flower beds, shade trees, fountains, band stands, etc. These gardens are fenced in by fencing made from old condemned fish plates and bolts, bolted together in many different designs which are quite unique, but expensive. They also make fences from old worn-out flues. The pickets are cut in 3-foot lengths, flattened and sharpened on one end for the top; the railing is made from the whole length of flue, all bolted together by ⅜-inch bolts. Mostly all platforms are low; that is, about 10 inches above the track. The edge is made by laying old rails, bolted together, on a stone foundation, with tie rods running back to the building to keep them in place. The space is then filled in with stone and cement, rolled smooth on top, making a good substantial platform.

One cannot help observing the many uses old rails are put to in buildings; they are used for girders and beams throughout a building, for roof and awning supports; in many shops and engine houses they are used for columns for girder supports; they are riveted together, base to base, and are set in castings cored out to fit.

CARRIAGES OR PASSENGER CARS.

These cars, like all others, are all shapes and styles. One would naturally think the companies were trying to make a collection of different style of cars. They are all 9 feet wide, but vary in length from 20 to 54 feet. They can, however, be classed as superior to any European cars. These cars are divided into three classes—first, second, third. The outside of the first-class car is painted blue; second-class, yellow; third-class, green; plainly lettered, without any striping. Some cars are partitioned off in the center—one section for first-class passengers, the other for second-class—these are painted one half yellow, the other half blue; and the same combination for second and third class—these are painted half yellow and half green. The second-class cars are the most favored, and are uncomfortable, from the fact of always being crowded.

The entrance to all cars is on the end by platform. Usually the aisle is to one side. Three persons can sit comfortably on the wide side, and one on the narrow side.

All the first-class cars are finely finished, inside and out. Some are all compartments (eight in number), while many have compartments in one end, aisle on one side; the other end contains ten chairs and one end seat; by unfolding the chairs they can be converted into couches. In each compartment there is sitting room for six people, and only sleeping room for four. The seat is one berth, while the back is on hinges, and is raised up and supported by a swinging brace; this is then converted into another berth, so in each compartment there are four berths which are quite comfortable. There is also a cushion pillow, and as almost every traveler in European countries carries a blanket and often a pillow, a good night's rest can be had.

These cars also contain ladies' and gentlemen's lavatories and closets. They are poorly ventilated, and poorly lighted by candles. No drinking water. Heated by steam from a special boiler car in the middle of the train. Double windows dropping down, floors carpeted, and everything kept perfectly clean.

The second-class cars are arranged similarly inside, but only have two compartments in the center and four seats in each end, the backs swinging up to form sleeping berths; seating capacity for forty-eight people, and sleeping capacity for thirty-six. They are also poorly ventilated and poorly lighted. The third-class cars have wooden benches with backs to swing up and make a lying-down place; these are very dirty and very poorly lighted.

Some of the cars have two pairs of wheels, some three, and a number of first and second class now have four wheels and double truck and can be called good riding cars. All cars have screw couplings with safety chains and spring buffers. They are also equipped with Westinghouse automatic brake. Conductor's valve in each car, and sealed. Conductor's bell or whistle rope carried on hooks near the roof on outside of car.

CARS AND WAGONS.

There does not appear to be any standard at all in any class of cars, as they are all shapes and sizes. The average box car is 15 to 22 feet long, 9 feet wide, and a capacity of 8 to 15 tons, and has two pairs of wheels. The flat cars, 16 to 23 feet long, 9 feet wide, capacity 8 to 18 tons.

Recently some new flat cars were put in service on the Nicholas line, 35 feet long, 9 feet wide, capacity 24 tons. The frames on these cars were made of 10-inch channel iron, four 1½-inch truss-rods, four wheel trucks with pressed-steel frames. The Vladicaucase railroad has been putting new oil-tank cars in service, (illustrated on page 150) which, for design and appearance, are superior to any we have on the American lines. These tanks are 6 feet in diameter, 38 feet long; the frame or body of the car is made of two 10-inch channel irons and two 12-inch channel irons, well cross-braced and riveted, and have two 1½-inch and two 2-inch truss rods. The tanks have heavy angle irons riveted on the under side, and these rest on timbers running the whole length and securely bolted to the channel iron frames, which are about 4 feet wide. There are no side-walks or running boards on these cars. They have four wheel trucks with pressed-steel frames. All wheels have wrought-iron centers with steel tires and Mansell retaining ring. Screw hand brakes are connected to one truck.

LOCOMOTIVES.

They have a great variety of engines, many of the old inside-cylinder six-wheel engine, and makes from England, France, Belgium, Austria, Germany, Russia, America—from Grant and Baldwin. They are of all shapes, styles and sizes, and, as a rule, could be called neat and clean; many are models of cleanliness. They have for several years past been getting many new engines of German and Russian make, all two-cylinder compounds; some with link valve gear, and many with the Joy valve gear. The two-cylinder compounds have not given the satisfaction expected, and have been a great source of annoyance by giving out on the road.

A great number of new Baldwin (Vauclain compounds) locomotives have been put in service the past year in different sections, and from the tests made with the German and Russian makes of two-cylinder compounds and the new Baldwins of equal size and weight, the American engines have been in the lead in every instance. These engines are running side by side in exactly the same service, and all the enginemen are free in expressing their views as to the choice of the Vauclain cylinder engines, as they are called. The men claim they are more comfortable, easier to ride, easier to handle, and they can see all parts without getting under, as all the other makes of engines have the slab or plate frames.

Nearly all engines are now burning

The back boiler head has asbestos lagging and a heavy iron casing closely fitted to all bolts and fittings. The cabs are made of heavy sheet iron, well braced, large and roomy, but doors and windows small. Engineer and fireman stand on a level with the deck. Mostly all passenger engines are equipped with speed recorders, many of the Boyer make. The speed gage is always placed in easy view of the engineer.

SIGNALS.

Not much attention has been given to interlocking and semaphore signals until lately. Now some of the lines are about equipped, but to no degree of perfection as on American lines. All stations have a semaphore with distance signal worked by single wire. Cross-over and yard switches are always attended by a man. At a number of switches leading from the main line to a side track, they have a padlock to prevent the lever from being tampered with, and also a large lock in the center of the track which is spiked to one of the cross-ties, and this is bolted into the switch rod by the switch tender, who carries the key, which is about 10 inches long and weighs several pounds. In switching and making up of trains, all signals are given by sound; that is, the switchman has a tin horn which he blows, and the engine driver is obliged to repeat this signal by whistle before he

SCENES ON SIBERIAN RAILWAY.

From Lodian, Tomsk, Western Siberia.

naphtha oil for fuel, with excellent results. This oil is the refuse from the first refining, and costs about 40 cents per barrel. This oil is also used for general lubricating purposes.

I saw a number of new compound two-cylinder engines, Russian make, that were burning wood. In these days of modern locomotive building it appeared quite a novelty to see a wood-burning compound engine with a large balloon stack.

All engines now in passenger service are equipped with the automatic air brake. Engines in freight service have the hand screw brake, and the last new ones the American steam brake. All the driving boxes and tender-truck journals are lubricated by wool wicking feeders, and have good success with it. None of the engines have bells, but instead have two whistles.

The engines are finely painted; the wheels red, frames black; jacket and cabs green, with a fine black stripe; the inside of cabs nearly white, or a cream color.

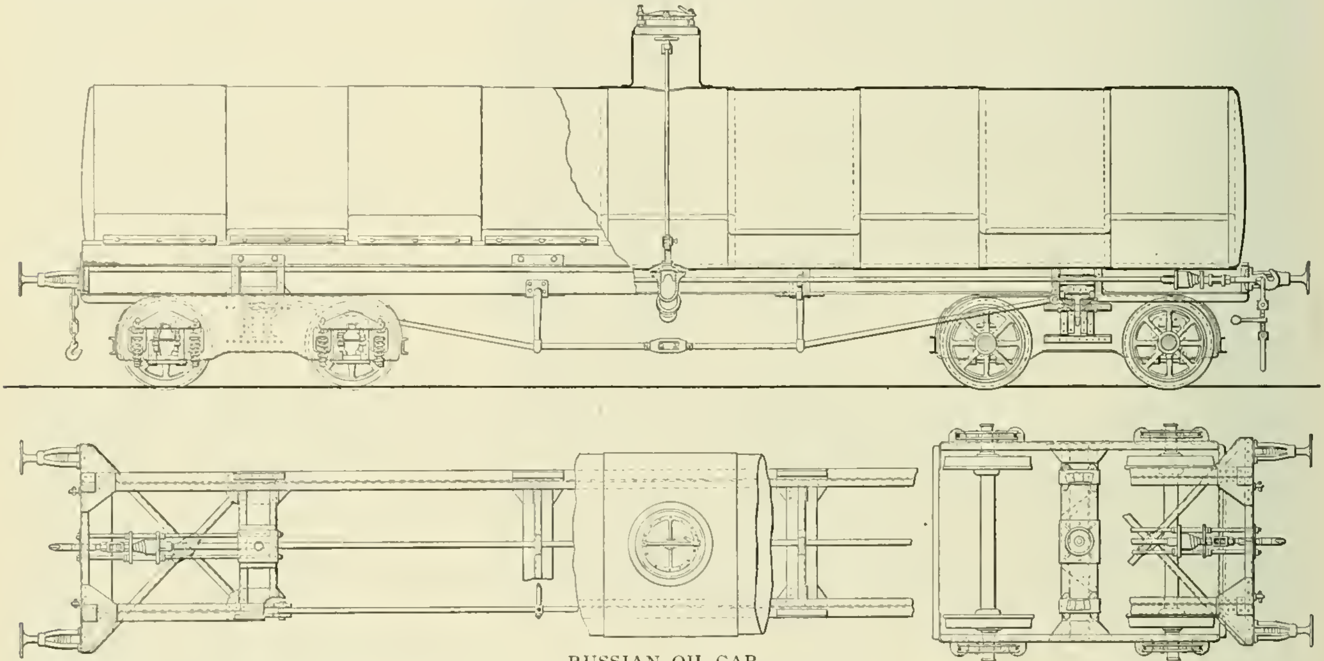
moves or stops the engine. He is also obliged to sound the whistle three short blasts after the engine is stopped. One can easily imagine the music in a yard where there are six or eight engines switching. All switch lights are red, white and green, and have about the same indication as in America. The tail or rear-end lights are red and green, and are very large, about 12 inches in diameter.

MISCELLANEOUS.

Naturally, most all employés are natives; a few Germans can occasionally be found as engine drivers, and a number of shop foremen are Germans.

I might mention at this point, in reply to the numerous letters received from American railroad men inquiring for positions on the Russian railroads, that there is no show whatever unless he understands the language and is satisfied to put in longer hours for less pay. The enginemen work from eight to ten hours per day and receive about 125 roubles per month; this will be equal to about $64 American money.

The section hands are divided into gangs, about the same as in America; but instead of four and five men in a gang, they have about ten men, one boss, one clerk or time keeper. These men go to work in the summer at 4 A. M., have tea 8 to 8:30 A. M., breakfast 12 to 1, and work to 8 P. M.; and receive 40 to 50 kopecks per day, which equals to 20 to 25 cents in American money. The section boss is usually provided with a nice, neat house to live in, and keeps boarders. The house is always at a road crossing; and as all road crossings are protected by gates, the wife attends to closing the gates when a train is approaching. She stands there with all the grace and dignity of a Goddess of Liberty, holding a green flag, and from general appearance she is well fed.



RUSSIAN OIL CAR.

Locomotive Engineering

One can often see women and girls working on the track, placing stone edging on ballast, weeding, etc. Through the southeastern section it is more common to see them at work, and it can be often seen where they have their babies playing on a blanket or sheepskin beside them while at work; can also see the babies in a box or bag, suspended by a rope from the limb of a tree in the shade, swinging back and forward as contented as can be. During a severe snowstorm, when the track is likely to be blocked, they turn out, men, women and soldiers, to shovel snow.

Water tanks are usually built of brick and stone foundations, 18 feet high. The iron or wooden tubs are incased by a respectable-looking building of an old design, resembling somewhat the tower of an ancient castle. The tubs or tanks being so high, they can get force enough to run the water through the various buildings in the vicinity. The spout is about 4 inches in diameter and it takes some time to fill a tender. They are now erecting a number of standpipes which are modern, with a 7-inch spout. These standpipes have a stove bolted to the base of the column, to keep from freezing in winter.

The shop buildings, as a rule, are large and have plently of room in them, but are dark, from the fact that the windows are all double and are not kept clean, the machinery is not very modern, and one will not find what could be called an up-to-date shop with modern labor-saving appliances.

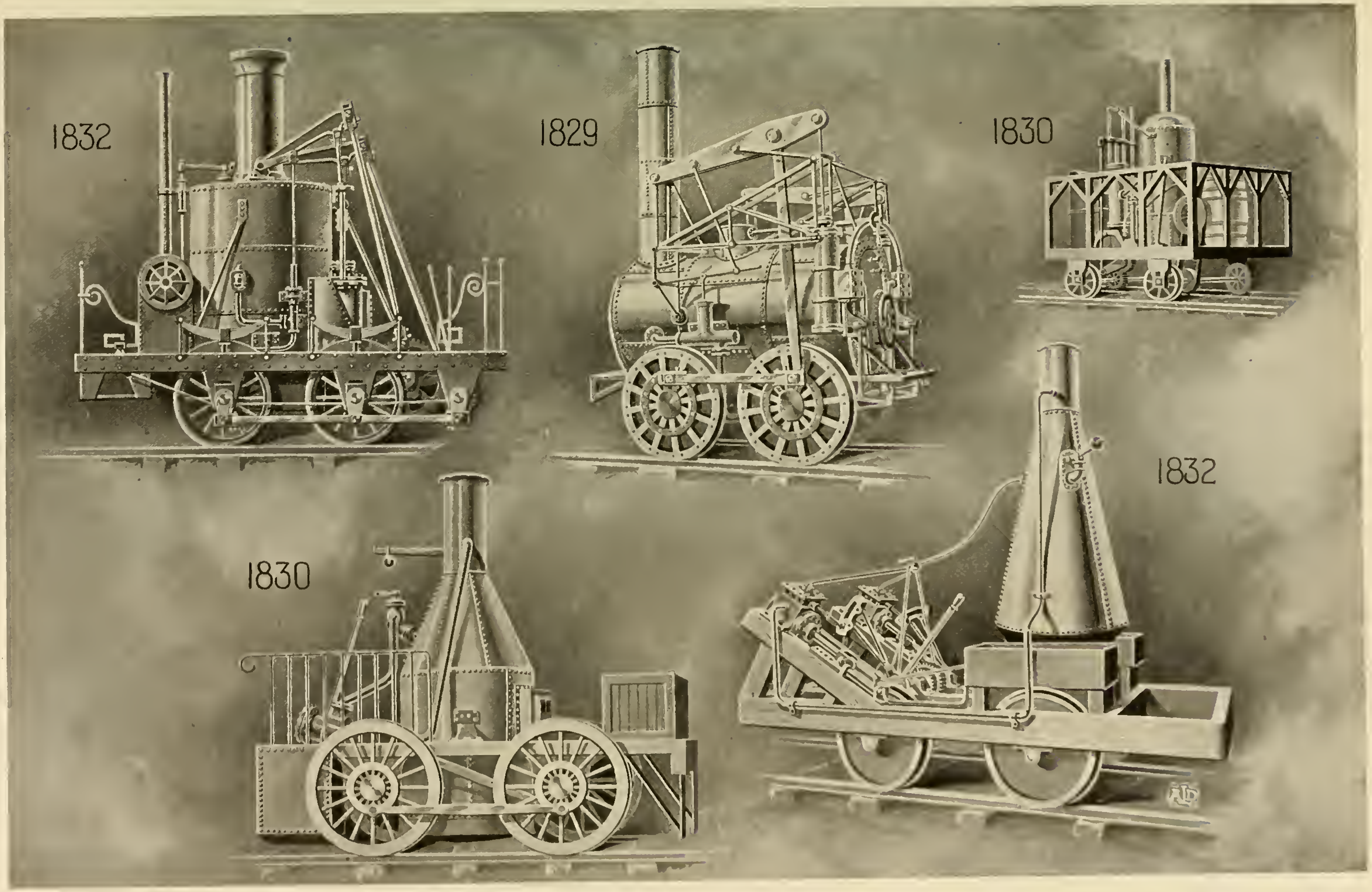
The speed of freight trains is limited to 20 miles per hour, while the fast express is limited to 35 miles per hour.

All distances are measured by the verst, which equals 1,167 yards, or 593 yards less than the United States mile. The foot has twelve divisions, called inches, and this inch has six divisions. The foot equals 13.75 United States inches. The metric system is used for scale drawings and shop work. All weights are calculated by the pood, which is 40 pounds, or equal to 36.8 American pounds.

Samara, Russia.

There is in use, in the erecting shop of the Schenectady Locomotive Works, a new form of experimental electric lamp, made by the Edison people. When seen at a distance, it looks like an ordinary arc lamp; but on closer inspection, it is a small double truncated cone, in which two carbons are used—the same as in an arc light. It is in the same circuit as the incandescent lights, and a current, equal to that required for ten incandescent lights, is said to make it as powerful as an ordinary arc lamp, and is between 800 and 900 candle-power.

A movement has been started in England by Mr. C. E. Stretton in favor of a National Railway Museum. There are a great many relics of railway appliances that have valuable historical interest, that will soon be lost to posterity unless some systematic method is established of collecting and preserving them. It it a pity that the movement did not take active form forty years ago. Had that been the case, hundreds of articles, long ago destroyed, would have been preserved that were of the greatest value as relics of early railroad efforts. This is the case where "Better late than never" is good philosophy, and we heartily wish that great success may attend the movement.



GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 2.

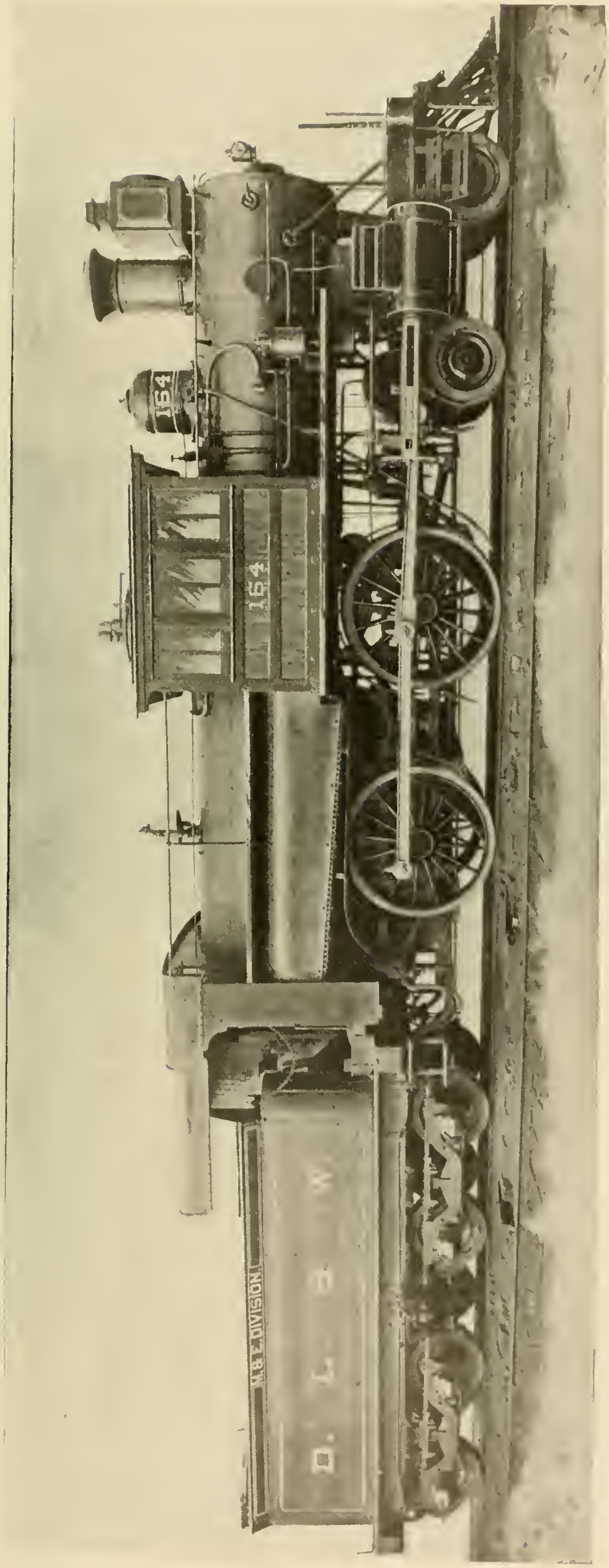
1832. The "York." Built by Phineas Davis for the Baltimore & Ohio.

1830. Horatio Allen's "Best Friend." First train locomotive built in America.

1829. "Stourbridge Lion." First locomotive tried in America.

1830. Cooper's "Tom Thumb." First American locomotive to demonstrate that locomotive traction was practicable.

1832. Locomotive built by William T. James. First time link motion was used.



LATEST DELAWARE, LACKAWANNA & WESTERN ENGINE.

Delaware, Lackawanna & Western Passenger Engine.

Our engraving of the eight-wheeled passenger engine for the Delaware, Lackawanna & Western Railway shows a machine built by the Dickson Manufacturing Company, quite similar to one designed by Mr. D. Brown, master mechanic at Scranton, Pa. Culm is the fuel to be burned, and judging from the success that has attended its recent use, there is no reason to doubt the outcome in the present case. The problem of successfully utilizing the immense culm piles has been one of no small moment, but it was practically solved when they were made to give up some of their stored energy in hauling freight and passengers.

A fair general idea of the prominent features of the engine will be had from the following description:

Type—Eight-wheeled passenger.
Simple or compound—Simple.
Gage—4 feet, 8½ inches.
Fuel—Culm.
Steam pressure—160 pounds.
Diameter of cylinders—19½ inches.
Stroke—24 inches.
Steam ports, length—17¼ inches.
Steam ports, width—1½ inches.
Exhaust ports, length—17¼ inches.
Exhaust ports, width—3 inches.
Bridges, thickness—1⅛ inches.
Valves, kind—Allen-Richardson, balanced.
Valves, travel—5¼ inches.
Valves, outside lap—1 inch.
Valves, inside lap—0 inches.
Valves, lead in full gear—1-16 inch.
Piston rods, diameter—3½ inches.
Piston rod packing—Jerome metallic.
Wheel base of engine—22 feet 11½ inches.
Driving-wheel base—8 feet 6 inches.
Wheel-base of engine and tender, total —49 feet 1 inch.
Length of engine and tender over all—59 feet 3 inches.
Driving wheels, diameter over tires—68 inches.
Driving-wheel centers—Cast steel.
Engine-truck wheels, diameter—33 inches.
Weight on rail under drivers—79,500 pounds.
Weight on rail under engine truck—37,500 pounds.
Weight of engine, total—117,000 pounds.
Tractive power, at 90 per cent. B. P., minus 10 per cent. for friction—17,400 pounds.
Co-efficient of adhesion—4.56.
Height, center of boiler above rails—8 feet 6 inches.
Height, top of stack to rails—15 feet 1 inch.
Stack, kind—Straight.
Stack, diameter—18 inches.

BOILER.

Type—Wootten.
Diameter of smallest ring inside—56 inches.

Thickness of cylindrical plates—½ and ⅝ inch.

Seams—All double riveted.

Firebox, kind—Above frames.

Firebox, length inside—10 feet.

Firebox, width inside—8 feet.

Firebox, depth front—46⅝ inches.

Firebox, depth back—39⅛ inches.

Firebox, side sheets, thickness—5-16 inch.

Firebox, back sheet, thickness—⅜ inch.

Crown-sheet, thickness—⅜ inch.

Tube-sheets, thickness—⅝ inch.

Tubes, material—Wrought iron.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—12 feet 6 inches.

Tubes, number—220.

Heating surface, tubes—1,439.9 square feet.

Heating surface, water grates—104.72 square feet.

Heating surface, firebox—175.22 square feet.

Total heating surface—1,719.84 square feet.

Grates—Wrought-iron water tubes.

Grate area, total—80 square feet.

A Journal Club.

In connection with his instruction in mechanical engineering at the University of Minnesota, Professor Hibbard has introduced a method of instruction from the reading of current engineering literature, which is well worthy of imitation, and might be followed to advantage in every school, society or evening class where students ought to be well-informed concerning existing practices.

He has established what he calls a "Journal Club," which meets weekly for the discussion of articles that appear in technical newspapers. Each member is allotted one weekly, and, if possible, also one monthly, which he is required to read with care and report to the club whatever of its contents he judges of sufficient value for discussion. Speaking to the Northwestern Railway Club on the subject, Professor Hibbard said:

"As an example of the methods, a particular case may be taken. One paper has an article upon the uses and costs of compressed air in a railroad shop. A preliminary discussion by the club makes it evident to the instructor that a more extensive reading-up upon the subject is needed by the members before it can be profitably discussed, and it is put over one week to permit this. Each member fills out a blank slip relating to each important item presented to the club, and it is placed in its proper alphabetical order in his private 'card index' of technical information and references."

An improvement on his sanding apparatus has been patented by Mr. Henry L. Leach, of Cambridge, Mass.

Baltimore & Ohio Trainmen.

The Baltimore & Ohio Railroad Company appears to be doing more for the education of enginemen than ever has been done before, although the old management of the Baltimore & Ohio had spent considerable money for school and library purposes in connection with their headquarters at Baltimore. The aims of the old educational system seemed to be—Try and make college professors of all the young men belonging to the road; the new system seems to aim to aid enginemen and others to the understanding of the science problems immediately connected with their business.

Knowledge concerning their business is now made a condition for obtaining promotion. We notice that there is a wonderful increase in the number of subscribers to "Locomotive Engineering" lately on the road, and that from being one of the lowest roads for subscribers on our list, it promises to be one of the best.

In the new order of things, there seems to be no knowledge of high science required from the men; everything is practical. A circular issued by Mr. John Billingham, one of the master mechanics of the road, is representative of what is going on on other divisions. He is urging upon enginemen to be more careful in the saving of coal. In this connection he says: "As near as it can be figured, it has been shown that when an engine blows off, the waste of steam amounts to the consumption of ¼ pound of coal for each second it continues, or about a shovelful of coal per minute from the tank, and it should be borne in mind that if an engine is allowed to blow off, it amounts to practically the same thing and costs as much money. A fireman should watch the engineer and water closely, as the engineer is sometimes compelled to put water into the boiler to prevent steam blowing off, and at this time no coal should be used, as it is a waste."

Why Foundries Do Not Receive Improved Tools.

A discussion has arisen between the "Foundry" and the "Iron Trade Review" regarding a question asked in "Locomotive Engineering" some time ago as to why the foundry is the last place to receive the benefit of improved appliances. The "Iron Trade Review" took the ground that the hostility of molders has been the principal cause to hinder the introduction of new appliances. In regard to this charge the "Foundry" says:

"We are on this point compelled to differ with our worthy contemporary. It is true that opposition has been manifested by workers in all trades against any innovations threatening to take away their present chance to earn a livelihood, but it is also true that such opposition has never been allowed to prevail nor been able to sustain itself against the condemnation of public opinion. Every improvement that has been made in any line of industry has carried with it opposition, because it became necessary for its successful working to either displace individuals altogether or else reduce their number; they have been compelled to find other avenues of employment, and this has at all times produced some friction. But every improvement is soulless and pushes itself to the front just as far as its merits will allow, and if foundry improvements have not been able to secure introduction, such is not caused by the molders' hostility, but by a lack of merit or a failure to show merit.

"What molder objects to the power crane that deprives him of the chance to strain his back? Who finds fault with the sand conveyor or the trolley track system that ease the burden of manual labor? Did you ever find a molder who refused to pour a casting with the geared ladle? Did a case ever come to your notice where the molders refused to accept a better illumination because it would allow them to do more work?

"A leading manufacturer of molding machinery recently mentioned that the old cry about molders' hostility was becoming antiquated and should be buried along with the campaign lies of the season. The officials of the molders' union have never expressed any hostile views on the introduction of machinery and improved appliances—nor have any others possessed of sufficient intelligence to be considered good citizens.

"The large number of molding machines in actual use testifies that the molders' hostility has not amounted to anything. The number of machines that have been installed and taken out again, have been discarded, not because any effective boycott had been placed on them, but because they lacked the quality so essential to all improvements, that of being money-makers."

Slipping of Driving Wheels.

As there are always discussions arising periodically concerning the cause of the slipping of driving wheels when the steam is shut off, and as there are a great many curious theories about the cause, we submit some ideas expressed by the veteran master mechanic, Mr. Wilson Eddy:

"When the throttle is shut, the drivers drive all that is connected to them, instead of being driven. Suppose we take a locomotive in running order and jack it up so that the drivers are clear from the track (or perhaps the experiment would be more satisfactory if the driving wheels are removed from the shaft and cranks put on the ends of it for the purpose of making connections), and then apply power sufficient to turn the driving shaft 280 turns in a minute, that would be the number a 54-inch wheel would have to make to run 45 miles an hour. It is plain to be seen that we not only have to put everything in motion connected with the drivers, including weight of the parts, compression in the cylinders and friction, but that all must be stopped and started, or the motion reversed, at every stroke of the pistons, and the pistons make four strokes at every revolution of the wheels, or 1,120 in a minute. I think, if the above experiment should be tried and the power computed, the result would be surprising, and the question settled that speed is sometimes obtained on long, steep grades sufficient to cause the drivers to slip, for it matters not, as far as that is concerned, whether the drivers drive the pistons or the reverse; the point of resistance in either case is the adhesion of the drivers, and when that is overcome, all know the result. An engineer asks: 'Why is it that the drivers will slip so long after shutting off steam?' My answer is: The longer the engine runs after the throttle is closed, the dryer the cylinder gets; consequently, the greater the friction on the packing, making more resistance to be overcome."

ON ONE OF THE PENNSYLVANIA LINES WEST OF PITTSBURGH.

Freeing Boiler Tubes of Scale.

The removal of scale from boiler tubes is no mean item in the expense account of roads that are obliged to use water strongly impregnated with scale-producing elements, and the methods resorted to by different roads to accomplish the same end is a fruitful theme for thought.

Mr. J. N. Weaver, master mechanic of the Lehigh Valley Railroad at Sayre, Pa., removes the scale from all tubes by heating and immersing in a tank of cold water. It has the double charm of novelty and thoroughness to recommend it. There is no scale left on a flue after this treatment, which consists in laying flues in a wide furnace, constructed for the purpose, outside of the boiler shop, and after they have acquired a low red heat they are thrown into a tank conveniently near. The sudden contraction of the metal on cooling in the tank, sheds every particle of scale, leaving the tube as clean as when new, both inside and out.

A wide contrast is afforded between this way of doing business and the primitive scheme of sawing a tube back and forth on edges of two half-round files secured in position on a bench or horse, or even the later execrable nerve-destroying rattler. There is only one arrangement that anywhere near approaches the efficiency of the furnace and bath, and that is the machine with steel rollers through which the flue is fed, but this does not take the scale off as thoroughly as Mr. Weaver's method.

The Lehigh Valley Drawing Office.

The superintendent of motive power of the Lehigh Valley road, Mr. S. Higgins, has apparently adopted some correct methods to get tangible results from the administration of the affairs of his department; that is, he has around him a corps of subordinates who are up in their respective duties, and besides, he has kept in view the fact that a well-managed drawing office is one of the institutions that it will not pay to let languish for want of nourishment.

At the Easton shops is a drawing office with all appointments of the first order, and one that has talent to put to their legitimate uses all of the accessories provided to do work with; the staff consisting of Chief Le Van and four first-class men, the whole under the charge of Mechanical Engineer Taylor. As on most large systems, the drawings are centralized at some one point, and in accordance with that idea, all prints for new work, or involving change of detail in old work, are issued from this office. This, of course, makes a system of filing and indexing necessary in order to avoid confusion in the care of the immense number of details in both locomotive and car work.

The equipment of the Lehigh Valley is one of wide diversity in point of motive power, and the question of reaching a standard has been one of great magnitude; for the interchangeability of parts, as far as possible, had become an absolute necessity. The most important of these parts were: Cylinders, cylinder heads, piston heads, driving boxes and driving springs. Those who have never tried to bring order out of chaos, simply cannot comprehend the slow growth of such a move, until it is explained that the standard part does not come into use except in case of failure of the old work, as a rule; but a general overhauling is when the standard is brought in evidence, in the reduced weight of castings and in shapes that bear the imprint of to-day.

Old-Time Railroad Reminiscences.

BY S. J. KIDDER.

I wonder if it does not cause a smile, and again perhaps a chill, when old-time railroaders fall into a reminiscent mood and recall ludicrous scenes enacted, or the extremely loose methods with which trains were run years ago, with some of which, perhaps, they may have been personally connected.

If written up, they no doubt would be equally as interesting to your army of readers as have been the cuts and descriptions of the old locomotives that from time to time have appeared in "Locomotive Engineering."

CURIOUS TRAIN DISPATCHING.

On a certain single-track New England railroad, a train dispatcher was considered a luxury rather than a necessity, and the passenger-train conductors did their own dispatching, when conditions appeared to justify, in a manner both crude and attended with danger by no means remote. If one of two opposing trains was late, the conductor of the belated train would send a telegram to the other conductor, designating some station, other than the regular meeting-point, where they should meet. This message being sent, the receiving operator was expected to deliver it to the party addressed, and he in turn to his engineer. These messages were passed from one to the other, verbally, without any pretense of ascertaining whether they were understood properly, or, in fact, understood at all. This practice finally came to an abrupt conclusion, for one day the train that should have been notified, passed the flag station without stopping and failed to receive the "meeting order." Two passenger trains came together with most dire results, and verbal train-dispatching was relegated to the archives of the things that had been. Following this, a train dispatcher assumed the controlling movement of trains by telegraph, though he worked a day-trick only, and it was a number of years before a continuous system of train-dispatching was inaugurated.

ENGINEERS WEARING PLUG HATS.

Coal had not come into use as fuel, and "wood burners" were the rule. They were more cleanly in the cab than modern coal burners, and overclothes were not considered a necessary adjunct to the enginemen's apparel. An engineer wearing a tall hat was not a novelty, and one of the banner engineers of a Boston road might be seen any day on his engine with his standing dickey, plug hat and swallow-tail coat.

CROWDED WHEELS.

Blind tires were the rule on front drivers of eight-wheel engines, and some of the old inside-connected Hinkleys had their driving wheels in such close proximity, that a recess was turned in the face of the blind tires to provide clearance for the flanges of the back drivers.

FEW PILOTS USED.

Pilots, more generally known as cow-catchers, were not used on some roads. The only provision for clearing the rails, or protecting the front wheels from obstruction, was a vertical guard over each rail, bolted to the bunter beam, to the bottom of which was attached a stiff brush, slightly clearing the rail. During the winter season a plank was bolted to these guards, parallel to and under the bunter beam, and placed sufficiently low to prevent the snow from entering the ashpan. These crude appliances were abandoned only after a stray bovine or horse had trespassed upon the track and ditched the engine or train.

MEETING POSTS

Among the time-card rules on many roads was one pertaining to white posts. These were placed midway between stations, and when two trains moving in opposite directions got between these stations, the one reaching the post first had the right of way, and the opposing train backed up and took the siding. It has never been recorded how many accidents resulted from each train endeavoring to reach the goal first, intent on making the other fellows back up.

AGAINST THE LINK MOTION AND OTHER IMPROVEMENTS.

A new Amoskeag engine came to a Massachusetts railroad. This engine weiged 28 tons, and was so heavy that no one cared to run her. She was the first, also, on the road with the link valve gear. One morning, one of the old reliable engineers started out with her to make his run, with a two-car passenger train.

All he knew about links was, that after attaining partial speed, the proper caper was to "hook her up." He tried it; but the gear, being a little stiff, jerked with each turn of the wheels. Something evidently was wrong, and the reverse lever was tenderly dropped in the corner, where it remained. A couple of stations beyond, our engineer saw his old "hook motion" attached to a wood train, standing on the siding. He traded engines, coupled to his train, and, with the engine backing up, completed his trip.

The advent of air brakes came very near precipitating strikes on a number of roads, for more wages. Engineers looked upon the innovation as a means of transferring to them the work formerly done by the brakemen, and they took the stand that their pay should be increased accordingly.

Some of the older roads had roundhouses surmounted with a high dome, and in these houses were turn-tables of extremely abbreviated length. Every time an engine was put in or taken out of the house, or turned round, the tender was uncoupled from the engine, the former being pushed on or off the table by a gang of men.

On a little New England road three engines did the work. The three engineers and firemen in turn filled the dual capacity of both. For instance, one day Engineer Smith would have Fireman Brown; another day Engineer Jones would have Fireman Smith; the next it would be Engineer Brown and Fireman Jones, and so on through the scale.

MAKING TRAINS WAIT TILL PLAY WAS OVER.

The writer remembers an occasion when he was a new man on a New York road. One day I was running the third of four sections, all of which reached their destination about 6 p. m. The roundhouse blackboard had us all scheduled to depart on our return trip at 8.30 the same evening. The engineers and conductors went to the lunch room for supper, and while waiting to be served, a conductor remarked that George Fox was playing at the opera house.

Another suggested that we all go to the show, which met with general approval. In my ignorance I reminded them that we were marked to leave at 8.30. Instantly I was "set down upon" and informed that I couldn't leave town until the rest did. I fell in, went to the show, and about 11.30 we proceeded to the freight yard, coupled to our trains and departed, no one about the roundhouse or freight yards seemingly taking sufficient interest in our delay to inquire its cause.

Chicago, Ill.

General Interest in the Locomotive.

It is wonderful the warm interest manifested by all classes of people in the locomotive engine. Hundreds of the most interested readers of "Locomotive Engineering" are not connected in any way with railroad work, but they like to read the paper on account of the articles relating to locomotives—the most wonder working machine of modern times.

The interest in the construction and working of the locomotive is studied keenly by thousands of railroad men who have no connection with the mechanical department, and books on the locomotive are found on their book-shelves. They like to know something of the mechanism which produces such wonderful speed, and like to be able to talk intelligibly about locomotive operating. From the greenest brakeman to the hoary-headed president, there is pride displayed in talking familiarly about the size of cylinders, driving wheels, etc., and in giving intelligent reasons for the preference of one make of engine over another. Nor is the knowledge acquired always of a superficial character. We are acquainted with railroad presidents who can talk parts and proportions of locomotives as intelligently as the ordinary master mechanic, and this of men who never had any direct connection with mechanical work. Their great interest in the engine has kept them informed of every step in its development, and acquiring technical knowledge on the subject has become a labor of love.

New Way of Shortening the Water Leg.

W. B. Paist, of the Baldwin Locomotive Works, who has recently returned from Brazil, tells of a new way to repair boilers in use on the Baturite Railroad, in Cerra, Brazil. On this road they had a class of engines that rolled on curves and accumulated so much side play in boxes that the inside of tires wore through the side of the firebox. This was repaired by moving the washout plugs and grates above the line of wear and filling the water leg to a point above the holes with cement. No trouble at all was experienced with or on account of the novel patch.

Early Engineering Appliances.

We reproduce from the "Practical Mechanics' and Engineers' Magazine," Glasgow, 1842, a steam-engine indicator and an oil-testing machine, designed by Mr. McNaught. These devices bring us to a realization of the fact that we of to-day cannot lay claim to everything in sight in the way of original engineering thought, and they are interesting when compared with our present methods of reaching the same results.

The indicator, it will be seen by the scale attached to the cylinder, was made to register low pressures; it is not so greatly different from the later indicators, except in the absence of a multiplying and parallel motion for the mechanism actuating the pencil. The other essentials are there, crude maybe; but they made a start in the development of the steam-engine ind'cator, rough as they were.

We quote from the magazine referred to, the description of the oil-tester:

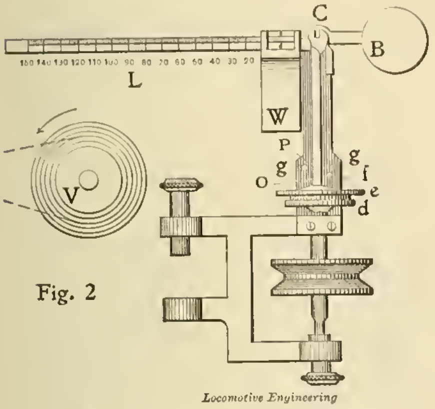


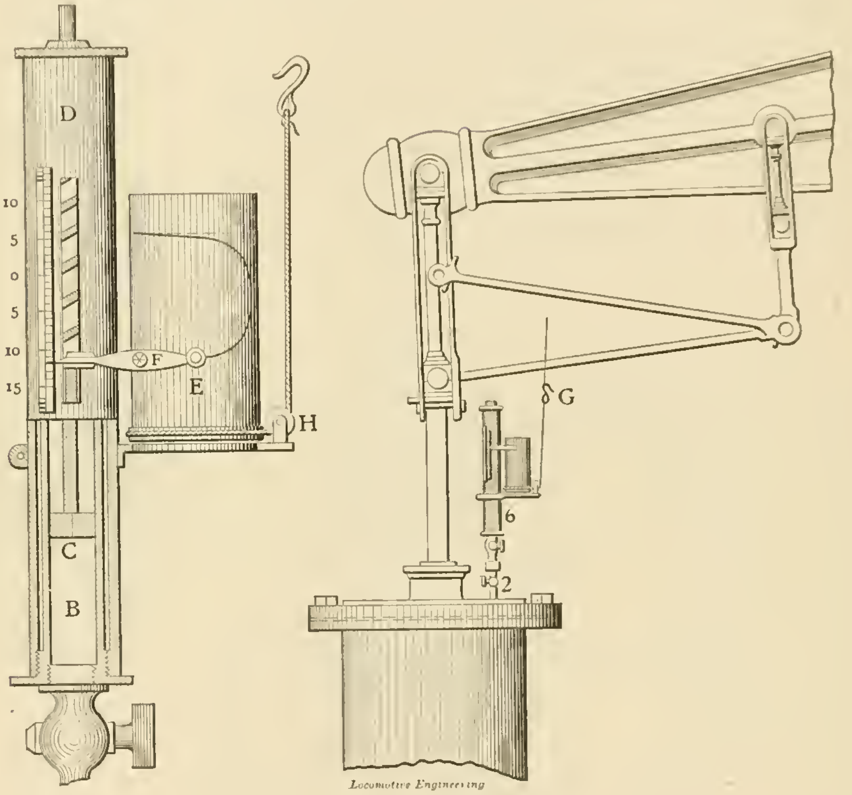
Fig. 2

McNAUGHT'S OIL TESTER.

"The oil tester is an instrument for ascertaining the quality of oil as applied to machinery, or for burning; it shows exactly the different degrees of tenacity, and in what degree different oils lessen friction, or what the lubricating qualities of the oils submitted to trials are, and enables a person in a few minutes to ascertain with certainty the relative values of what he means to purchase and to compare the stock with the sample he has made trial of.

"*A* is a cramp with its screw for fixing the instrument; *P* is a pulley for driving the arbor, *D* is a piece of brass screwed on the top of the arbor, for holding the oil to be tested. The top of the arbor passes through the socket of the upper plate; those plates are turned perfectly true and flat, but do not touch each other; this is regulated by a small screw on the top of the socket of the upper plate, which can be screwed down so as to prevent the plates touching each other, only leaving a thin film of oil between. As much oil must be put into the cup of the under plate as will just appear above the upper plate; the motion will cause the superfluous oil to fly off.

"*F* is a pin fastened to the plate, which, when turned against the sun, will come in contact with the pin *P*, and endeavor to carry it forward towards the stop on side next the cramp. The stops are to prevent its being carried too far out of the perpendicular. *W* is a sliding weight, being kept steady in any situation by a small spring. *C* is the center upon which the lever turns, being supported in the upper part of the brass frame; the lever is divided into 150 equal parts. *B* is a counterweight. When the mark upon the counterweight corresponds with *O*, the graduated leg of the lever will be horizontal; and the leg *P* will be perpendicular, plunging freely between the stops without touching either of them, and is then in equilibrium. *V* is a pulley with



McNAUGHT'S INDICATOR.

six or eight grooves varying about one-eighth of an inch each; for the convenience of finding the desired speed and for immediate application it is supposed to be fixed on the point of a turning lathe spindle, the cramp being fixed to the lathe rest. The rest will slide out or in so as to answer the driving band and the different sizes of the pulleys.

"When the oil to be submitted to trial is put between the plates and the apparatus is set in motion, the sliding weight may be shifted above the graduated lever till it stands at some point, for instance, with good sperm oil; if it is brought to such a speed as to indicate 30 upon the scale, then neat-foot, olive and gallipolic oils will be about 60.

"To judge of the correctness of the instrument, let a trial be made of equal parts of different oils; suppose one of them to stand at 30, the other at 60; then the medium is 40. This will be the case if mixtures have been equal; however, it will be sufficiently near to show that bad oil cannot be mixed with good without being detected.

"As oils sold under the same name differ so much in quality, it is impossible to state precisely the speed that will make any given oil point to a given number; but as comparative trial is all that is wanted, every person will be able to do this for himself.

"From what has been explained and described, the principle upon which the instrument is constructed will be easily comprehended. Thus, if with one kind of oil the tenacity will only lift the weight of 20, and another at 40, it is evident that the tenacity of the former is but one-half of the latter, and will lessen friction in the same proportion, as far as oil is concerned, thereby leaving it in the option of the proprietor of machinery, whether he will save his money in oil, and waste it in the purchase of coal, or waste the power otherwise, besides the injury of the machinery."

A new, improved system of storing electricity is under trial in London. Great improvements have been effected in the arrangement of the leaden bars, which is the principal material used in storage batteries. Those trying the battery say that it will reduce the weight of storage batteries about one-half.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

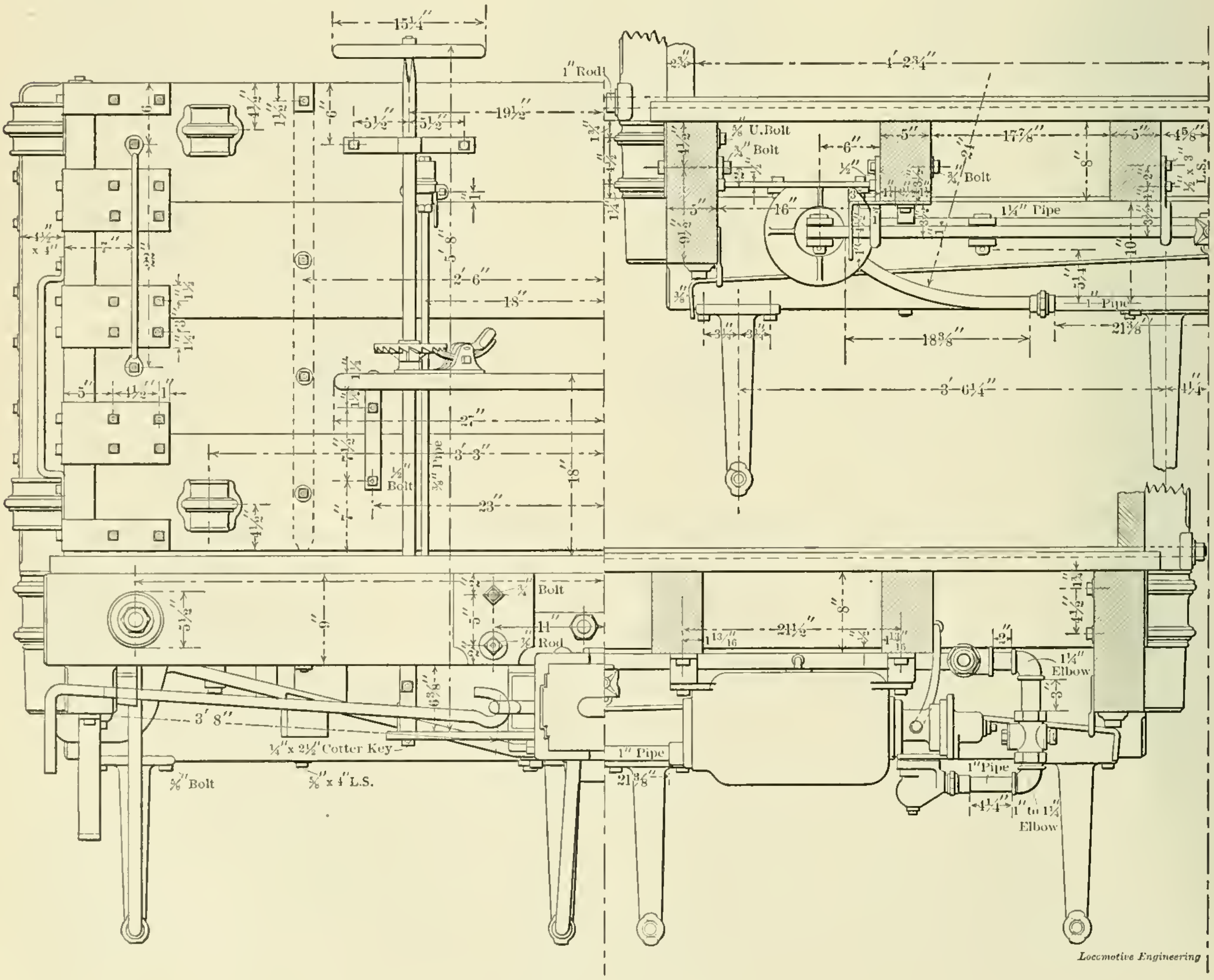
Double Drop-Bottom Coal Car, 65,000 Pounds Capacity.

Our illustration of a coal car for heavy service shows a design of Mr. C. E. Turner, superintendent of motive power of the Buffalo, Rochester & Pittsburg Railway, who has given much thought and attention to the needs of this particular branch of service, because of the fact that the coal trade comprises a very important part of the traffic on his line.

This car is 35 feet long outside of end sills, and 8 feet 11 inches wide outside of side sills. Length inside, 33 feet; width inside, 8 feet 5½ inches; and height inside, 3 feet 10½ inches. The end sills are 8 inches wide by 9 inches deep. There are six longitudinal sills—the center and intermediate being 5 x 8 inches, and the outside 5 x 14 inches, the latter having a lip on the underside, extending to the front face of the end sills, which in turn project beyond the outside face of the side sills. Here is seen a good solid foundation to resist the trials of the exceptionally hard service of a mountain road.

The arrangement of the truss rods is an object lesson in car trussing, that is alive with healthy suggestion to those in a position to absorb the hints and profit by them. There are four rods with bodies 1¼ inches in diameter, and ends upset to 1½ inches for nuts and turnbuckle, with depth of truss at the cross-tie timbers of 34½ inches. The advantages resulting from the care devoted to this detail are plainly a low fiber stress on the rods, even if they are called upon to sustain the entire load, and therefore a freedom from stretch; an item that figures largely in car maintenance, and that is conspicuous by its absence in this equipment. The location of the two intermediate truss rods between the center sills, for the purpose of avoiding the drop doors, is a practice that might well be adopted on other cars, for the reason that rods so placed will then deposit their load on the body bolsters at a point near the origin of moments, and thus eliminate the bending moment present on the bolster when their loads are made to come outside of the center sills or near the intermediate sills—their positions, in general practice. In these cars the only trouble from this source is confined to the outside pair of rods.

The wrought-iron body-bolsters are formed of two plates in the usual way for bolsters of this type; that is, the upper plate has a shoulder forged on for the lower plate to abut against, but here the simile ends, because these bolsters have a depth of 10½ inches over the plates at the center—a most unusual thing; indeed, so rare that attention is invited to the fact. Stiffness was the prevailing idea in this



65,000-POUND COAL CAR.

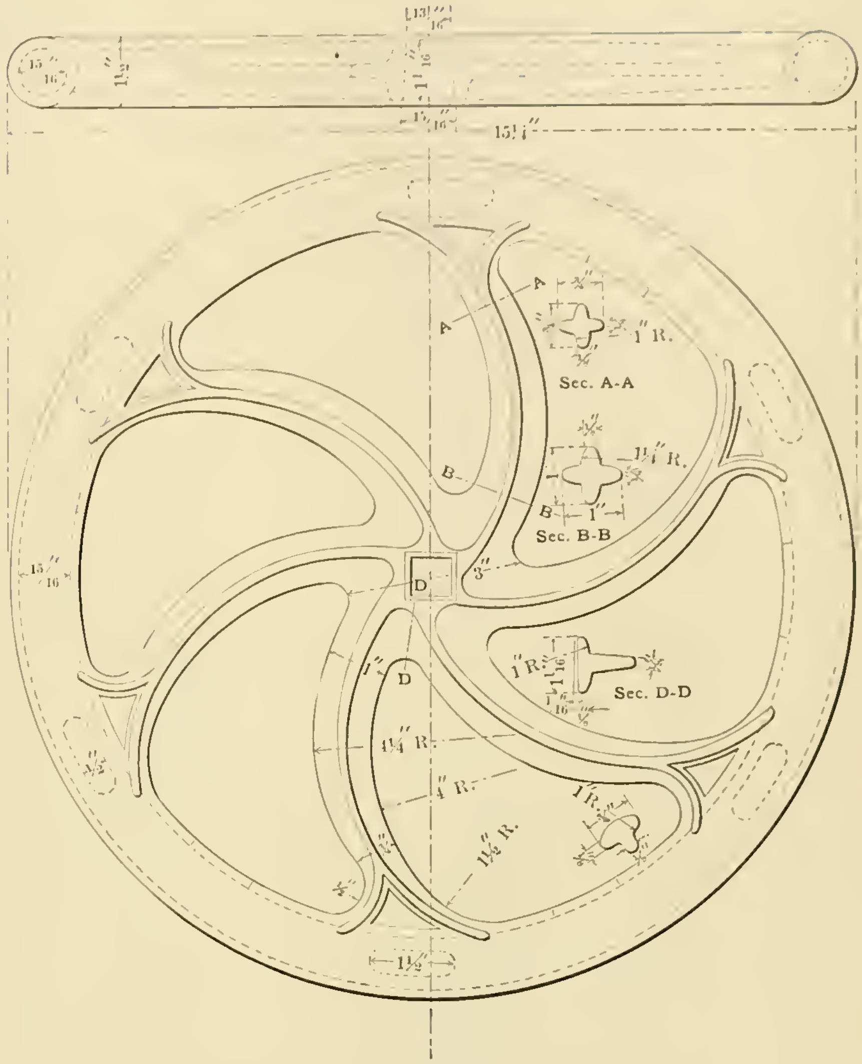
design, and we are informed that all expectations looking to the divorce of side bearings have been realized.

A novel construction has been followed for the ends of the bolsters at their junction with the outside sills, in which the bolster is ¾ inch short of the inside faces of the sills, and is connected to same by a malleable bracket casting, which is bolted to the top of the bolster and the inside of sill; the castings pass under the sill with a lip. These castings also form the seats for the outside truss rods. The center and intermediate sills are gained ½ inch for the top member of bolster, and the latter has hooked bolts, ⅞ inch in diameter, passing forward to the end sills. To resist buffing shocks, there is a solid wooden block fitted between the draft timbers, with its front against the drawbar spring case and its rear against the bolster, the block solidly secured with ⅝-inch bolts, making a strong job at the draft rigging.

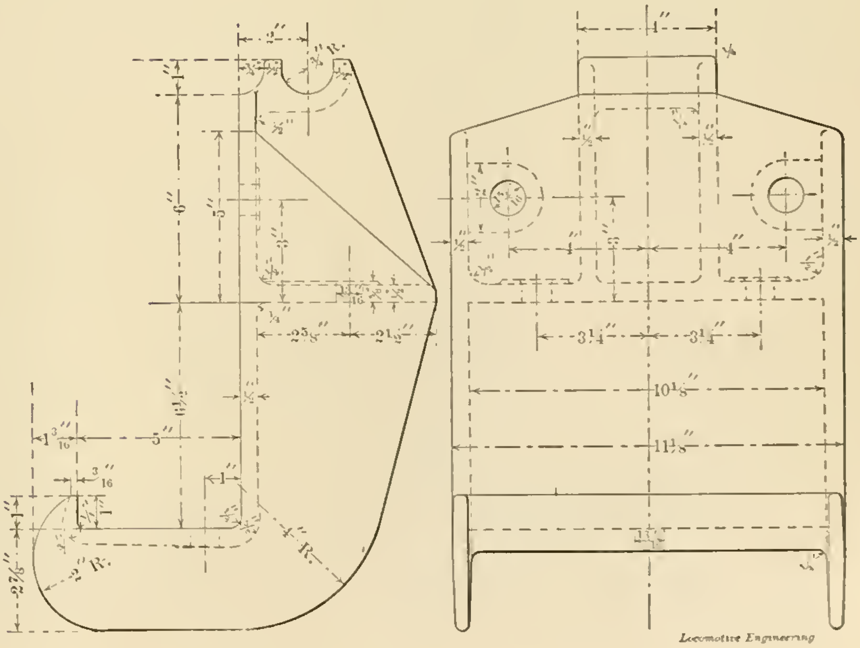
There has been a great deal of trouble with the bulging of coal sides on all cars of the gondola kind. One of the best methods for the cure of this evil is shown on this car. It consists simply of two 1-inch round rods passing across the car and through the two center stakes, on line with the flooring. Sufficient tension can be placed on these rods with the nuts at their ends, to spring the sides in at the top and prevent bulging with the load. It is an inexpensive way to solve what has been found to be a serious problem with coal cars.

Malleable iron has been used in these cars to a very great extent, with the view of keeping the dead weight within reasonable bounds. This is a practice long out of the swaddling clothes of experiment, and conceded by prominent authorities to be one of the best avenues out of dead-weight complications; yet, notwithstanding the fact that its advantages are so well known, its general introduction is slower than its merits deserve. In this case, however, it has received full recognition. The engravings will, we think, repay a critical study of all details by anyone interested in modern car construction as developed to meet the most rigorous condition of freight service.

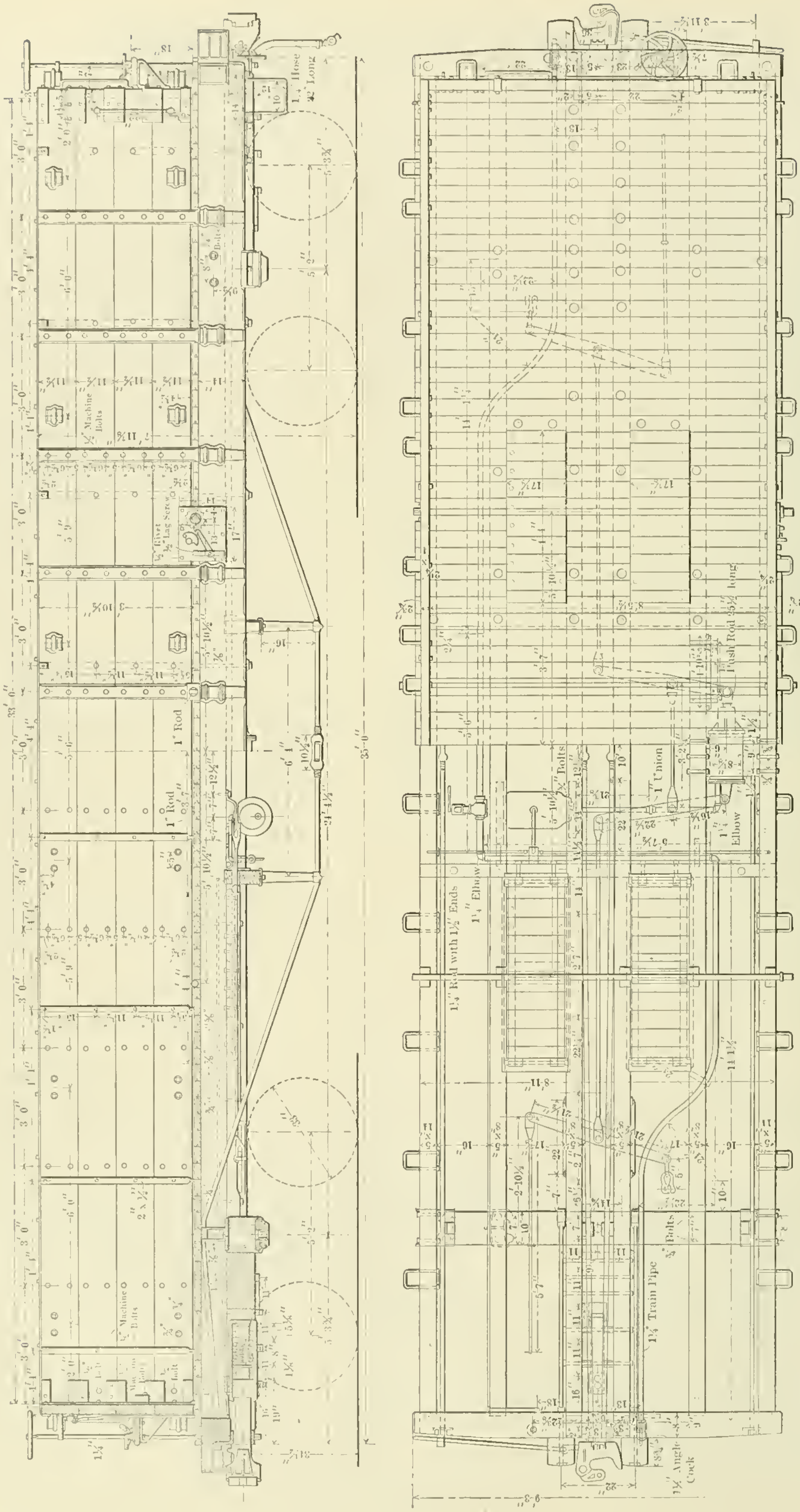
If a statement by Mr. Hiram S. Maxim, whose name is familiar to the engineering world through his gun inventions and experiments with flying machines, is correct, the world is going to get a new quality of steel which appears to rival the diamond in hardness. He says that his brother, Mr. Samuel Maxim, has produced a form of steel that is capable of drilling a hole through any British steel made as hard as fire and water will make it. In addition to going through the hardest kind of material, Mr. Maxim asserts that he is prepared to shave himself with the drill.



BRAKE WHEEL—65,000-POUND COAL CAR.



BOLSTER BRACKET—65,000-POUND COAL CAR.



Locomotive Engineering

DOUBLE DROP-BOTTOM COAL CAR.

The Standard 60,000-Pound Car.

In the month of November, 1896, the Ohio Falls Car Manufacturing Company sent out circulars to those interested in car construction, inviting an expression of their preferences of constructive practice, for the purpose of establishing a standard 60,000-pound car, having the Master Car Builders' standards and recommended practices as a base.

The result of this move up to date is shown in the following tabulated statement, sent to us by the sponsors of the scheme. It will be seen that there is not such a wide difference of opinion as to warrant the belief that such a standard is impossible of attainment. It is no easy task to get men on record in a matter of this kind, and the results assume a value not to be underestimated on that account. When it is understood that there is no reason for perpetuating the present maze of differing dimensions for cars of the same capacity, the full import of the good work inaugurated by the Ohio Falls Company will dawn on the minds of those responsible for them.

A standardizing of the woodwork alone in a car, would be the means of saving thousands of dollars yearly to many corporations that can ill afford to lose them. That fact ought to be incentive enough to insure united action on the part of those who make standards for our railroads.

	Barney & Smith Car Co.	Locomotive Engineering.	The Terre Haute Car and Mfg. Co.	The Elliot Car Co.	The Ohio Falls Car Mfg. Co.	United States Car Co.
Clear inside length	33′ 0½″	36′ 0″	33′ 6″	34′ 0″	34′ 0″	33′ 4¼″
" " width	8′ 3½″	8′ 0″	8′ 4″	8′ 0″	8′ 2¼″	8′ 1¼″
" " height	7′ 2″	7′ 0″	6′ 9″	6′ 11″	6′ 8¼″	7′ 0¼″
Door opening	5′ 0″	5′ 6″	5′ 0′	6′ 0″	5′ 6″	5′ x 6′ 6½″
Center to center of center ties	6′ 10½″	8′ 10″	4′ 6″	6′ 9″	6′ 3″	8′ 0″
Section of side sills	5″ x 8½″	5″ x 9″	5″ x 9″	5″ x 10″	5″ x 9″	5″ x 9″
" center "	5″ x 8½″	5″ x 9″	5″ x 9″	4″ x 10″	5″ x 8½″	5″ x 9″
" intermediate sill	5″ x 8½′	5″ x 9″	4″ x 9″	4″ x 10″	5″ x 8½″	5″ x 9″
" side plate	3½″ x 7″	....	4″ x 6″	....	3″ x 6″	3″ x 8″
" end "	3½″ x 12″	....	....	....	3½″ x 12″	3″ x 13″
Height of lining	3′ 6″	7′ 0″	3′ 6″	4′ 0″	4′ 0″	2′ 6″
Truss rod's diameter	1¼″	1⅜″	1⅛″	1⅛″	1⅛″	1¼″
" " end	1⅜″	1¾″	1⅜″	1⅜″	1⅜″	1½″
Wheel spread	4′ 10″	5′ 0″	5′ 0″	5′ 6″	5′ 0″	5′ 0″
Upper arch bar	4″ x 1¼″	1″ x 4″	1¼″ x 4″	1¼″ x 4″	1⅛″ x 4″	1¼″ x 4″
Lower " "	4″ x 1⅛″	1″ x 4″	⅞″ x 4″	1⅛″ x 4″	1″ x 4″	1″ x 4″
Tie bar " "	4″ x 0⅝″	⅝″ x 4″	⅝″ x 4″	⅝″ x 4″	½″ x 4″	⅝″ x 4″
Set of upper arch bar	....	6″	...	....	5″	5″
" lower " "	....	14″	....	....	12″	13″
" tie bar	....	....	...	...	1″	2¾″
Diameter of column bolts	1⅜″	1¼″	1⅜″	1¼″	1¼″	1¼″
" " oil box "	1⅛″	1⅛″	1⅛″	1″	1″	1⅛″

The Copper-Plated Passenger Car--New York, New Haven & Hartford.

An evolution in the outside finish of passenger cars was recently seen in this city, embodied in a day coach. By invitation of Master Car Builder Appleyard, of the New York, New Haven & Hartford, we had an opportunity to inspect this example of a metal-clad car, which was covered on the outside with No. 28 sheet copper.

The general appearance of the car is quite similar to those with the wooden sheathing, with the exception of the absence of battens, which is at once noticeable. The copper sheets are placed on the outside face of the regulation sheathing, in strips a little wider than each board, and extending up from the bottom of the sills with a flashing under the belt rail; the strips being of such a width as to cover the tongue and fill the groove of each sheathing board, which is double-grooved, presenting a face of about 1½ inches in width.

Between the windows the finish is the same as below the belt rail, the copper passing under the letter board, which is also covered, and both made tight by flashing as previously noted.

The copper plates are oxidized before application to the car, and each piece is then rolled to the wood, leaving a handsome smooth surface, in color much resembling the so-called standard or olive tint; this, taken in connection with the metallic sheen which is present, notwithstanding the dulled surface, gives a satin finish greatly different from that of varnish, and one expected to outlast anything heretofore obtained by the latter means.

If all expectations are realized, this copper plating of passenger cars will work a revolution in lowering paint-shop expense, since there is no paint or varnish used to get these results, which compare so favorably with the best work of the painter.

The total weight of the copper used on this car is only 1,000 pounds, but by reducing the thickness of the sheathing, the weight of the car remains practically the same as before the copper was used. Considering the fact that special tools had to be devised to apply the copper sheets to the car, and that the men who did the job were the regular employés, who had no previous training in this class of work, so different from their accustomed duties, Mr. Appleyard has abundant cause for his evident pride in this sample car.

Freight-Car Doors.

One of the most troublesome details of car construction that the master car builder has to wrestle with is getting a freight-car door that will open and shut without the use of pinch bars and sledge hammers, and continue after the car has sagged out of shape to close the opening against the entrance of rain, snow and cinders. A few years ago the Wagner flush door jumped into sudden popularity, and many railroad men thought that the difficulties with freight-car doors were at an end. At a recent meeting of the Southern Railway Club, Mr. R. P. C. Sanderson, of the Norfolk & Western, read the following amusing paper on car doors generally:

"If a parody on the once-famous sermon by a Mississippi flat boatman may be indulged in, I would like to say as a preface, Oh, my brethren, there are more kinds of doors that produce profanity than one door. There is the firebox door that you fire through, and the general manager's private door that you get fired through, the generally unmanageable all-fired vestibule door, and the saloon door that you invite another fellow through, and the salon door where the other fellow gets in first and keeps you out, and the safe door to keep burglars out, and the safe cell door to keep burglars in, and the side door that the trunks are thrown out of, and the side door that the drunks are thrown out of, and the single door and the double door, and the half door, and the swing door, and the sliding door, and the folding door, and the lift door, and the drop door, and the trap door, and the front door, and the back door, and the stevedore, and the commodore; but the box-car door is worse than all these.

"We still see on some of our neighbors' old-time 2 x 4 box cars, the aboriginal box-car door, an 'outside' door, or rather 'cover,' that had many faults, but we ought to be charitable to it and let it rest in peace.

"If there never had been any freight claim agent, there never would have been any flush door. The old-time door was made to cover the hole, when the car was new and square, with from 1 inch to 2 inches of lap. After awhile the door hole was changed from a rectangular one to an irregular opening, circumscribed by four compound curves, the top and bottom being curved downward, and the two sides being curved outward by bulging. The lap of the door being small, and the bulge of the sides keeping it from lying up close, the smoke, cinders and rain drove in and kept the freight claim agent busy standing off claims for damaged bulk grain, sacks of flour and boxes of corsets. In his efforts to compensate and settle claims, the freight claim agent could not help explaining this to the country storekeeper and farmer, which stimulated the dormant inventive genius of the bucolic mind, giving birth to the large family of flush car doors, which help to make flush times for the car repair men.

"The flush door, if it did not shrink, and if it could not get out of order, is morally a failure from its inception, because it presupposes that the door hole in the car is going to retain its rectangular shape. After the car has left the shop awhile and has settled, shrunk, swelled, bulged and warped, the problem of closing a close-fitting flush door, or opening it again if it has been closed, by the aid of a pinchbar, is only a modification of the old one of fitting a square plug in a round hole. This trouble with flush car doors is common to all of them, no matter what the gyroscutus may be like that is provided for the purpose of closing the door into the hole.

"With an outside-hung door it is a simple and easy job to insure a claim and damage proof joint at the top and locking side of the door, and by giving lap enough at the other side and bottom a pretty safe door can be secured even after the car has sagged and bulged, shrunk and swelled, to its full content, as the distance along which the rain and soot, or car thief's wire hook, must travel between the car side and door, due to the long lap, will prevent them getting at the contents of the car.

"The Wagner door depends for its success on top and bottom rails, and on these keeping the same distance apart. As these rails will not stay parallel on account of the springing, sagging, warping and shrinking, the upper shoes often come off the top rail and allow the door to fall off. It was at first supposed that this was due to the bottom shoe on the crank shaft wearing out, and to remedy this a cast or malleable bracket with flat foot is largely used to carry the weight of the back of the door; this relieves the crank shaft and its shoes of carrying all weight; they only have to answer the purpose of opening and closing the doors.

"As the Wagner door still continued to fall off, it was found that the trouble was not in the door so much as in the guides, it being almost impossible to keep the top and bottom guides anywhere near parallel under all conditions of load and service, even on modern strongly framed cars.

"The Wagner door depends for its successful working on the alignment of the bottom rail, as this has to guide the front of the door into position. It has been found almost impossible to keep bottom rails in any sort of good condition, as they are too convenient for use in supporting the ends of skids, and often carry the bulk of the weight of a piece of machinery, etc., being skidded into the car; they are damaged by wheels, stone and other heavy articles being dumped out of the car, and are constantly being bent and battered against the side of the car by heavy wagons being backed up against the cars.

"The crank shaft of the Wagner door is provided with shoes sliding on the top and bottom rails. The crank pins are not turned up in the lathe. The holes in which these pins fit are usually cored in the casting; consequently, we have a loose wiggly fit, and as the weight of the door is always carried at an offset equal to the arm of the crank, the loose fit referred to, followed by further looseness due to wear, allows the door to settle down out of position.

"The general bad condition of the Wagner doors around the edges, showing only too plainly the marks left by the vigorous use of a pinchbar, led to the belief that these doors, after closing, were being nailed by anxious shippers, so broad flat straps of iron were fitted around the edges of the doors. The result is just the same, only more so; for not only was the wood of the door, and the siding around the door, scarred and split up by the pinchbars, but the iron straps are pried off and curled up, adding to the trouble and expenses. Closer inquiry revealed the fact that the pinchbar was most needed on account of the doors getting jammed shut, by the gradual sagging of the cars under load, by the swelling of the wood in wet weather, and by the bulging of the car sides, although the trouble from shippers nailing doors does add to the necessity for the pinchbar. When a flush door has been nailed, the pinchbar must be used with destructive effect to force it open. The results of nailing an outside-hung door are not so bad, as the pinchbar can be pushed well under it, and you don't have to peck at it with the bar. Also, with an outside door, the nails can be got at and cut off with a cold chisel, which is not possible with a flush door.

"That the Wagner flush door is no better than an 'ornary' outside-hung door, as far as the weatherproof qualities are concerned, can be readily observed by visiting the yards and noticing the gaps over the tops of the doors, varying from a small crack to an inch or more in width, through which the sunshine, rain, snow and dirt can freely enter. Bad fitting up? Oh no! The doors are fitted up with only three-eighths clearance each way. Green lumber? No; it is as good kiln-dried lumber as can be got for car repairing. What is it due to? Why, to the settling of the door out of place, from the shaft and cranks bending, the shoes getting crooked, the bottom guides getting bent, the door shrinking, and the door hole stretching.

"The inventor of the Wagner door devised an arrangement for securing the handle on the crank shaft in either the open or shut position, by means of a small half-round casting with notches on the under edge, which drops over the lever and locks it in 'open' or 'shut' position. On this locking casting is the word 'Lift.' How often do we see people of education come to an office door with the word 'Private' painted on it in plain large black letters, and after gazing on the letters with a far-away look, walk in and ask if this is the Y. M. C. A. rooms, or Mr. Legal Shyster's law office, when the Y. M. C. A. and Mr. Shyster's signs are standing right across the hallway in large red and white type. Owing to this same peculiar trait of the ordinary human, a man who has not become an expert on car doors by long practice will read the little word 'Lift,' wondering what it is put there for, and forthwith get a lever or pinchbar or fence rail and pries away at the handle of the crank shaft in his efforts to turn it; the end of the struggle is a broken handle, or broken locking casting, and bad language. That this is no exaggeration is evidenced by a large number of broken and bent crank shafts and broken castings with the ear-marks of the bar or lever on the door underneath the handles.

"This trouble led some of us to do away with the locking casting, and hinge the handle so that it would drop down for safety when let go. Our ignoramus immediately makes use of this handle to pull the door open and shut; as he does so, he operates the closing device and jams the door fast against the car side. Ignoramus No. 1 calls Ignoramus No. 2, with a pinchbar, and while one pulls on the handle, keeping the door jammed tight against the side, No. 2 pinches it along, using the beaded edges of the car siding for 'holds' for the points of the bar; the marks on the doors and sides of cars often tell this story as plainly as a picture story can.

"One might answer this by saying the railroad companies shouldn't employ such ignoramuses to do their work, or should teach them. That may be so; but railroad companies cannot afford to send an expert along with each car to explain how the doors work to the men who cannot read at the shingle mills, bark sidings, quarry sidings, or to the negro freight hands in territories where such doors are not much used.

"To sum up the troubles with the Wagner car door in a few words, is to say that it bears on its face an ingenious mechanism for accomplishing an improper purpose.

"The first essential qualification for a successful car door is simplicity and the absence of all mechanism."

Practical Letters from Practical Men.

Throttling versus Close Cut-off.

Editors:

In studying the various arguments with regard to "Throttling versus Close Cut-off," the fact has been forcibly impressed on my mind that many a ton of coal has been wasted annually by one notch being too light to handle the train and the next one too heavy. Such an engine will perform differently with different engineers on her. One man will work a very heavy throttle with reverse lever in second notch, and each exhaust will be sent out with a short, sharp blast, which being intermittent has a disastrous effect on the fire, and the engine appears to be laboring continually.

Suppose with a notch on quadrant such engine will handle her train easily with half-closed throttle on the level. Suppose an engineer who advocates full throttle whenever possible goes out to run her. He will hook her in that notch, pull her wide open, and put his head out of the window and listen. He will conclude she does not clear herself, and down she goes into the next notch with throttle partly closed, regardless of what percentage of cut-off it is. Some men work an engine in a certain notch, regardless of everything. The same man will come to a hill and gradually widen out on the throttle until she is wide open; then when he gives her a notch without easing off on the throttle, he will lift the grates out, providing the fireman has not plenty of coal on top to hold them down.

Suppose another engineer goes out on the same engine who tries to see how easy, soft and prolonged he can make her exhaust and still do her work, regardless of whether she clears herself or not, which makes a constant drain on the boiler without fluctuations. This enables a fireman to keep a more uniform temperature without forcing the fire at times and retarding it at other times.

I had an experience with a 14 x 22 engine with 54-inch wheels, on a two-coach passenger run. The piston speed was very high, sometimes reaching 1,000 feet per minute. Over parts of the road where engine would handle her train in the center notch, which was less than 20 per cent. of stroke, and maintain high piston speed, was very economical; but as soon as piston speed dropped below a certain limit, it was better to drop her down to the next notch, which was about 30 per cent. of stroke, and throttle the steam. On this point W. De Sanno's "Eli" should show good results. It seemed as if the limit of economical expansion had been reached when the speed dropped below the point where condensation and re-evaporation exceeded the economy to be obtained with higher speed. When the speed dropped, the engine would seem to have a different exhaust, and labored hard to get rid of her exhaust steam, and it appeared to be damp and of greater volume, producing more compression. It also had a different effect on the fire.

The steam pressure carried has its effect on where to work the engine and throttle. Engines with short eccentric rods work better with the steam throttled than engines with long ones, on account of increase in lead with shorter rods.

A. A. LINDLEY,
Iowa Central Railway.

Oskaloosa, Ia.

New England Inspection Engine.

Editors:

Your article about "the inspector" on the Norfolk & Southern Railroad has suggested sending to you a photograph of the inspection engine "Boston," on the Fitchburg Railroad, a machine that was likewise rebuilt from an eight-wheel locomotive.

NEW ENGLAND INSPECTION ENGINE.

It was built at the Mason Machine Works, and was formerly on the Ashburnham Railroad, 2.58 miles in length, till that road became a branch of the Fitchburg system. The rebuilding was done by the Fitchburg Company at its locomotive shops in Keene, N. H., and its car shops in Fitchburg, Mass. The "Boston" has cylinders 12 x 22 inches, and a 38-inch boiler, while its weight, originally 48,000 pounds, is now 77,700 pounds.

The two rear windows on the side are in the cab, the other four being in the inspection room, which is finished in mahogany and maple. Comfortable willow chairs, cane-seated, together with plush cushions, are within the inspection room, upon tastefully carpeted platforms well arranged for observation by being raised where the boiler and the wagon-top rise above the floor-level. Artificial light is obtained by electricity from storage batteries placed under the engineer's seat, and the inspection room is supplied with heat from the boiler, the heat being regulated by means of registers. Communication between the inspection room and the cab is secured by speaking tubes and electric bells. The bell, hung on the tender, is rung by compressed air.

The design of the engine is artistic and tasteful. Its predominant color is dark olive-green, with ornamentation and lettering in gold-leaf, while the cylinder casings and handrails are of polished brass. Although similar to several engines built originally for inspection service, the "Boston" is, I believe, the first and only one introduced into New England.

G. FRANKLIN STARBUCK.

Waltham, Mass.

Some Suggestions to Car Inspectors.

Editors:

With the more general use of air brakes on freight cars, the necessity for better care of them and keeping down the expense of maintenance becomes daily more apparent. If the following suggestions to car inspectors are heeded, these men will contribute a great deal toward the ends mentioned:

1. Don't overlook the sure sign of needed repairs indicated by paper between hose couplings; but, by replacing the defective gasket, discourage the practice of so using paper by doing away with the leak the paper was intended to stop. A piece of cord wrapped around a train pipe at a joint often indicates a leak at that point. Be as ready to hear an air leak, and as willing to remedy it, as many men are to hear the whistle in the evening and at once to quit work. Pressure will then be more easily gained, and brakes will operate more satisfactorily.

2. Don't fail to turn angle cocks to the correct position, no matter who put them wrong. They are not infrequently seen pointing toward the outside instead of a little toward the center of track. This position soon results in a leaky and bursted hose.

3. Turn the hose couplings so they can be connected without a quarter or a half twist being given the hose. You will see many needing this change if you look for them.

4. Don't put a hose coupling into service, nor let one there remain that has been so bent as to bring its face too close to that of the other when connected. When in proper condition there should be about 7-64 inch clearance between the faces. In pulling apart, as must be expected in case of a break-in-two, this clearance decreases to a scant 1-32 inch; therefore, if not having very nearly the standard clearance when coupled, instead of pulling apart, either a hose will be torn off or the piping will be pulled from under the car. This and poor train-pipe clamping is responsible for many leaks at train-pipe connection to triple valve, and for broken branch pipes.

5. Keep the bolts well drawn up which attach the reservoir and cylinder to the car. When these are loose, there is a movement of the supported parts each time the brake is applied and released. Not only does this movement tend to cause a leak at the train-pipe connection to the triple valve, but it frequently results in breaking the pressure-retaining valve pipe off at the triple valve.

6. Keep all pipe clamps drawn up snugly, and don't fail to replace any that are missing. The sooner either of these jobs is done, the less it will cost, as delay will result in the development of other defects.

7. Don't imagine you can't adjust the piston travel properly on a freight car without air pressure. Shove the push bar back in the hollow piston rod until it strikes the piston; then make a mark on the bar just opposite the end of the hollow rod. Then set the hand brake with a "club," and the distance from mark on bar back to end of hollow rod will be the piston travel that would result from the air brake being applied.

8. When taking triple valves apart for cleaning and oiling, don't pull the branch pipe away from the valve after disconnecting the union. Moving this pipe helps to start a small leak when the pipe is brought back. Many small leaks equal a big one, and are much more difficult to locate and, as a whole, to remedy.

9. Don't let go unrepaired a brake beam which has lost a wheel guard. A few cents of expense here will often save dollars in damage resulting from the beam riding the wheel.

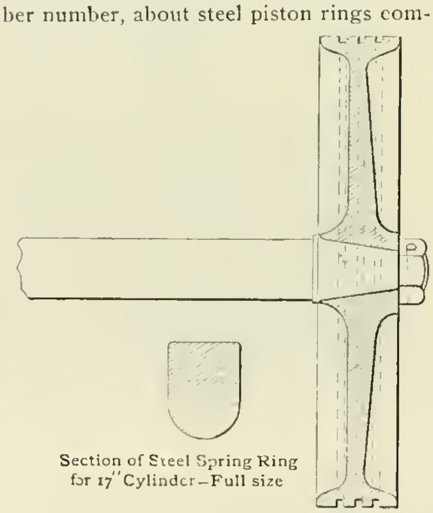
10. If you are stationed at or near the foot of a grade, and inspect trains that have just descended, don't fail to touch quickly with the bare hand one wheel tread in each truck. The comparative temperature of wheels will tell you the relative amount of brake work done, thus enabling you to detect the existence of many defects that would otherwise go unnoticed, or require a much more elaborate test to indicate their presence. If the wheels are much cooler in one truck than the other, or on one car than the average cars of the train, it is absolute proof that such wheels are not getting their share of brake power. With the knowledge that a defect exists, it is easier to trace, and there is more surety of its exact nature being determined.

F. B. Farmer.
St. Paul, Minn.

Steel Piston Rings.

Editors:

Referring to your paragraph in December number, about steel piston rings coming into use in Great Britain for stationary engine purposes, mild steel for packing rings has been in use for stationary and locomotive practice for a number of years with very good results. Mr. John Ramsbottom, when locomotive superintendent of the London & Northwestern Railway, prior to 1872, introduced these rings, which have since borne his name (the Ramsbottom packing ring); they were used on all London & Northwestern locomotives, including the compound, whose low-pressure cylinder took a 30-inch ring. I saw them in stationary engines nearly twenty years ago, where, for simplicity, cheapness and good wearing qualitites, they were, I think, without equal. Occasionally on locomotives we had trouble with them, on account of cylinders being soft, and they would wear out in a very short time; where this was the case we replaced the steel rings with drawn brass ones, the brass rings lasting just as long in soft cylinders as steel rings did in hard ones.



Section of Steel Spring Ring for 17" Cylinder—Full size

Locomotive Engineering

The following are some of the advantages of steel rings:

No tee or bull ring, follower plate or bolts required.

Lighter piston head can be used.

No lathe work required on rings, as steel is made of proper section, passed through rolls and finished.

Can be made to fit a cylinder that is not perfectly round. I herewith send you draft of piston head, also section of ring, which for a 17-inch cylinder was about 3/8 x 1/2 inch. As will be seen by looking at draft, three rings are used in each piston head, the joints being divided so that they are not opposite one another. I have seen these rings wear so thin, where the piston head was a close fit in cylinder, that when taken out they would not be more than 1/16 inch thick in places.

H. T. Bentley.
Belle Plaine, Ia.

"Peculiar Wear of Valves."

Editors:

The article with the above heading, on page 38 of January issue, according to my idea is not fully explained by the editor. While discussing this subject, I will endeavor to explain or answer question No. 2 of H. T., of Paducah, Ky., page 72; question No. 3 under the Head of "What You Want to Know."

The wear described by Mr. S. J. Hungerford's drawing is evidently caused by not letting the reverse lever down in corner while rolling down hill. As a rule, on fast runs engineers drop their reverse levers down about half way to the "corner," which does not allow valves to travel their full stroke, and instead the valve stops over the port and closes it before the piston completes its stroke, causing a pressure in cylinder sufficient to lift that end of valve, and causing the "peculiar wear" on opposite end, and vice versa.

It is evident, then, where H. T. gets his short puffs and exhausts, which occur when the compressed air lifts the valve and allows air, smoke, etc., to enter steam chest from exhaust openings—remembering there is always a partial vacuum in chests while rolling, caused by pistons acting as pumps; and when valve is raised, this vacuum is partly relieved from the smokebox, causing the puffs.

As Mr. Hungerford states that valves having the greatest travel, lap and lead show the most wear, it goes to substantiate the above idea. I also claim this lifting of the valve is one of the principal causes of slats and springs breaking in balanced valves, for this reason: While working steam, the springs and slats are heated to the temperature of the steam, and when steam is shut off, and rolling down grade, cold air is admitted through relief valves to chest and cools these springs suddenly and causes them to break, especially when they are of elliptical form. On this account I would suggest, that in renewing balanced valves, never leave any unnecessary space between the top of valve proper and the balance plate, which is often done when valves and seats are faced off.

W. W. PITTS.

Hillsboro, Tex.

A Successful Variable Nozzle.

Editors:

We have been experimenting with a variable nozzle on our road for the past two years at various times and under differing circumstances. As this is a subject of universal interest to railroad men in general and master mechanics in particular, I venture to give some of the results of our experiments. For ten days just passed we have run the engine equipped with this nozzle, on a local run having four engines of the same class, with conditions as nearly the same as possible. This engine has saved in fuel 2,332 pounds of coal per trip of 220 miles.

The engine steams freely, and at the conclusion of the test we enlarged the nozzle still further and she still steams. The nozzle is now set so that in first notch of quadrant it equals area of old nozzle, which was 4¼ inches, and in either corner it exceeds the total area of old nozzle by 2½ square inches.

Another advantage outside of its coal-saving qualities is, that it will save the continual changing of tips to meet the various conditions arising. On a hill or hard pull the uneven motion of all engines with small nozzles is entirely lacking, and no hitch is noticed as she travels over the centers.

The cost of the nozzle is about $29. We are getting out castings of nozzle for other classes of engines, to try it still further, and will be glad to answer all questions in regard to its performance. For the benefit of those interested, I will say that this is the square nozzle that has been described in "Locomotive Engineering" before (attached to reach rod), gotten up by two engineers of the C., St. P., M. & O., Messrs. Wallace and Kellogg, of Altoona, Wis.

L. H. BRYAN,
General Foreman.

Two Harbors, Minn.

AT THE NORFOLK AND WESTERN SHOPS, BLUEFIELD, VA.

Hose Screens.

Editors:

I have a spare engine to-day and have just finished cleaning out a hose screen. My hands are cut and scarred by the ragged edges of the hose nut beaten out of shape, my feet are wet, and I am tempted to ask a question: Why, in the march of improvement, have we returned to that relic of barbarism, the hose screen? Is it because of its insignificance that it has not been thought worthy of attention? If so, those in charge of the construction and maintenance of power should ride a trip with someone on a fast train while he is worrying with a tank of dirty water, and he will become enlightened. His water supply becomes strangled; the injectors won't keep up the proper level of water in boiler. He can't clean out the hose until a regular stop is made, and then probably a detention report to make out, only to be repeated several times during the trip.

Or you are working on a grade. You set your injector where it supplies the boiler. The fireman notices that she steams freer than usual, but don't let her pop to attract your attention. After a while you try your water, just to keep down suspicion, and find yourself terribly short. You can't spare your right injector to blow the dirt back. Your left one is treacherous. You are afraid to stop to fill her up.

Do you remember how you squirmed? I do, but have not been caught in that scrape for several years. I have a pair of screens, about the size and shape of a gallon measure, that fit snug over the tank valves. I take them with me when I change engines, and would not be without them for money. These screens will admit of a finer perforation than the hose screen, and made of sheet copper will last the life of an engine. Their advantage is apparent in more ways than I can mention. Take the case of a leaking engine. They admit of the use of anything that will stop a leak. No matter how much shavings, chips or straw it contains, force enough will pass through; that too coarse will remain in the tank until worn out by the action of the water. You never know it is there—unless perhaps you get a mouthful in taking a drink out of the tank cock. I don't claim originality, but do claim that I know a good thing after I use it.

If any of your readers wish to realize satisfaction after they have found it, let them have a pair of these screens made.

See that they are securely anchored down, to prevent the slashing of the water from moving them and letting dirt underneath. Then throw away the hose screen and they will leak no further.

R. I. Good.

Pittsburgh, Pa.

New Express Engines for the Northeastern Railway--Manchester, Sheffield & Lincolnshire Bogie Express Locomotives.

Editors:

Kindly allow me to correct an error which has unconsciously crept into my letter appearing in your December number, page 975, respecting the new express engines for the Northeastern Railway. It will be noticed that in the first part of my communication I have stated the cylinders to be 20 x 26 inches, and, farther on as 18 x 26 inches. The former figures are correct.

On page 965, in the same issue, you describe the Manchester, Sheffield & Lincolnshire bogie express engines as having cylinders 19 x 26 inches, and four-coupled wheels 7 feet 6 inches in diameter. These dimensions should be 18½ x 26 inches and 7 feet, respectively.

The Northeastern is at present the only company which possesses engines with coupler wheels of a nominal diameter of 90 inches; the railway using the next largest four-coupler drivers—viz., 87 inches in diameter—being the Lancashire & Yorkshire.

F. W. Brewer.

London, Eng.

Piston Rings.

Editors:

Referring to your paragraph on page 990, December issue, am not sure whether you meant to imply that steel piston rings were uncommon in locomotive practice. I only know of their use on one line, the L. N. W. Ry., England; I put in many a set when working there as far back as 1887. There were three in a set, about ½ inch wide by $\frac{5}{16}$ inch thick; made of mild steel. I never saw them made, being in their London repair shops, but should think they were very cheaply produced, as you could cut up the rolled rod to right length and then bend to required shape in the rolls; all ready for piston then; this required shape, by the way, wouldn't be circular.

When we found a soft cylinder, we used to put in a set of brass rings and lay the old ones aside; if they came out of re-bored cylinders, would do later on for smaller ones. These rings, owing to their small section and softness, hadn't much spring in them, but they could easily be "faked" when worn. We used to give them a light pening on the inside, holding the ring vertically on an iron block and working round the ring. They required a little care to insure their being circular when in the cylinder, instead of having flat places. Other things being equal, I prefer cast-iron rings, as I have a huge fancy for cast iron on cast iron. Had ample opportunities of seeing how it "panned out" when on the Brighton line, for, as you know, Stroudley used that combination largely. Slide blocks and slide bars; eccentric sheaves and straps; piston, rings and cylinders; slide valves and steam chest, are four of his cast-iron combinations that occur to me.

H. Rolfe.

Cambridgeport, Mass.

Evil Done by Drip from Steam Heating Pipes.

Editors:

I find that the steam heat on passenger and fast express cars is a very expensive thing to railroad corporations in its present state. The drips are so high from the ground that the wind blows the water on the rail, making ice and causing train to haul hard; also, when freight on side track follows, the drip makes it hard for them. A few days ago there was a freight lying on siding for a train of five express cars and one sleeper. When the freight followed, it took them two hours to go 4½ miles; they were making 12 to 15 miles an hour before taking side-track.

Some of the cars have drips in center of car; some on one side, over the rail; others near the truck, on end of car. There was one car on the train I had yesterday, and I noticed the drip was fastened so as to run directly on the rail on a straight line. I think there is room for the M. C. B. and palace car builders to improve this by bringing the outlets near the center of car and nearer the ground, so the wind will not blow the water on rail.

An improvement of this kind will be a great saving of coal, iron, sand; and the engine pulling the passenger train could make better time, the rail being free of ice; also the freight following. Even when it is not freezing, the drip on rail makes it very slippery for the freight train following.

James Hepinstall.

Greenbush, N. Y.

Relation of Expansion to Clearance.

Editors:

The question of the relation of expansion to clearance losses in steam engines has been discussed to some extent in the late engineering journals, and the conclusions of some of the writers appear to be extremely illogical.

Mr. Harris Tabor, in the January issue of "Locomotive Engineering," contends that the loss from clearance is greater with an early cut-off, because, as he says in effect, the capacity of the clearance spaces is constant, but the volume of steam admitted varies with the point of cut-off. The ratio of *initial* loss is, of course, greater with an early cut-off; but this is more than returned by the greater ratio of expansion. When steam is carried full stroke, the contents of the clearance spaces is total loss, because the effective pressure on the piston is not increased an atom thereby; but when steam is expanded, the additional volume contained in the clearance spaces helps to keep up the expansion line, and thereby increases the effective pressure. Therefore, the greater the expansion, the less the loss from clearance. Contrary results, should be attributed to increased condensation, or other causes.

Mr. S. J. Hungerford asks for an explanation of the wearing of the outer edges of the valve and valve seat, illustrated in his article. As compression, to the extent of the area of the port, counterbalances the pressure on the valve at one of its ends, but not at the other, the effect would, of course, be to increase the wear on the outer edges of the valve and valve seat.

W. F. Cleveland.

Moncton, N. B., Can.

Selection of Enginemen.

"It is the individual that reaches the highest round of the ladder, not the many. Men cannot be any more alike in ability to run a locomotive than in any other line of business," said Mr. W. E. Amman, in a paper read before the Northwestern Railway Club. "Railroads must have the percentage of bad with the good—the wasteful with the careful; but these conditions can be altered and a high average of intelligence attained if a proper method of system and discipline is maintained. The proper education of enginemen and firemen in the natural causes of combustion, and a strict compliance with rules and regulations governing coal consumption, would result in saving a considerable portion of what is now wasted through ignorance and lack of interest. In order to accomplish this result, much is required, and many of our roads are taking steps in the right direction. Too much credit cannot be given to those officials who are assisting their engine crews by the aid of literature, and employing capable and active traveling engineers to advise and instruct them in the way to get the desired results by proper use of fuel.

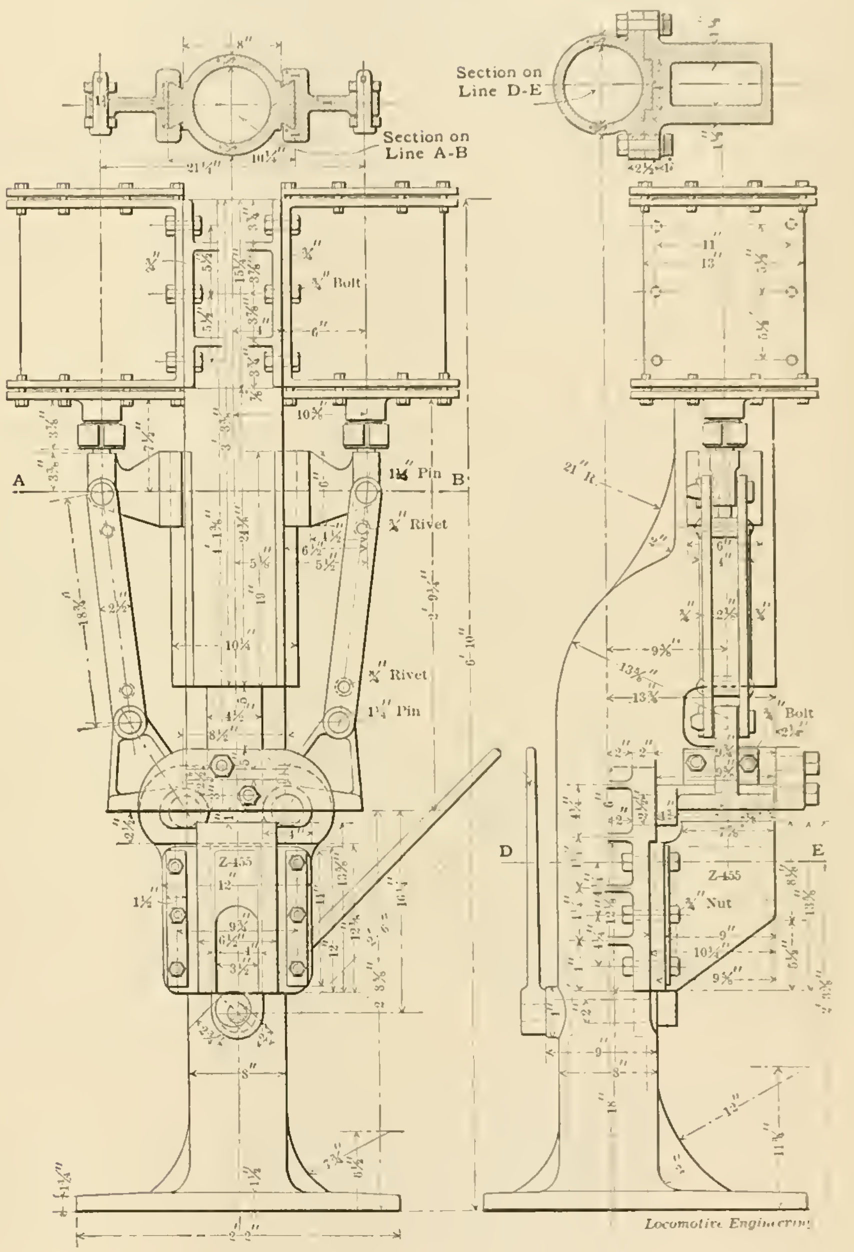
"When a judicious selection is made, the traveling engineer soon proves himself a valuable addition to the motive power department. His special knowledge of engines and men should constitute him a teacher, and we should look to him for a proper selection of material for competent engineers and firemen.

"Aside from all other sources of waste, there is none so great as that caused by careless and ignorant handling of engines on the road. The standard of excellence should be governed by their standing on the performance sheet for cost of coal, oil and repair. This will always prove to be an incentive for energetic and ambitious enginemen. Everything consistent should be done to foster in them a spirit of interest in their work. Inattention or indifference to their suggestions or complaints are serious obstacles to their advancement, and invariably result in loss to the company. We frequently find cases where an engineer and firemen are not agreeable to one another. The work of one does not suit the other. Such cases should be investigated without delay and a change made, as no economy is effected under any circumstances by keeping them together. The fireman cannot fire an engine with economy if the engine is not properly handled; neither can an engineer run his engine with satisfaction unless it is fired to the best advantage. Inflexible rules for firing cannot be followed. Conditions are not always alike; which make it necessary that engine crews should be men of ready conception, that their work can be made to conform to the existing conditions. The early education of the fireman should begin in the shop, where the rudiments of railroading should be taught, and the capacity of the apprentice can be observed. Selecting material for firemen from butcher shops, grocery stores and the farm, and sending them out a few trips to learn how to fire, is a practice that cannot be too strongly condemned. It is costly to the companies, and does not permit of the experience necessary to make competent and reliable engineers. If heads of mechanical departments would remember that the preceding generation makes the next succeeding, we would have less poor enginemen and better coal records."

Machine for Bending Drawbar Yokes.

In the forming of drawbar yokes by hand, the blacksmith has no easy task to bring up corners and get a reasonably good job, without an expensive outlay of time. The device that will do this job cheaper and better than it can be done by the mauling-into-shape process, is a boon to the smith, and a money-saver to the company employing it; such a machine we herewith illustrate. It was designed with the end in view of bending the 1 x 4-inch iron into shape for a yoke at a single movement, and was built new for the purpose. Nothing was picked up to do duty as a makeshift in this case, and fail to do what was expected of it with the regularity known of such construction, but each part was adapted to and made for the work it had to do.

A cast-iron frame, 6 feet 10 inches high, carries all the accessories for doing the job. At the top of the frame is bolted a pair of 12 x 12-inch air-cylinders, having leather packing on both sides of the piston—for motion in two directions. The pistons connect with a crosshead made to work in suitable dove-tailed surfaces on each side of the frame, as shown in section *A B* of the frame and crossheads. On the latter there is pivoted a pair of ¾ x 2½-inch links, extending down to the bending arms. These arms are journaled into the frame on the rear side, and into a heavy bar at the front, and are at such a distance from center to center as will bring their faces, when in a vertical position, equal to over-all depth of the yoke when finished. Located below the bending arms is the block former, over which the bar for the yoke is bent. This block is bolted securely to the frame and has slotted holes for adjustment; the bolts, however, are not depended on to hold it vertically, this being accomplished by means of an eccentric on the end of a short shaft, and actuated by the lever shown at the rear of the machine.



The forming block has outside dimensions equal to the finished inside face of the yoke, and the latter, as a flat bar, is laid on the top of the block as a preliminary to the bending, after which air is admitted to the cylinders and the bending arms turn on their journals, forcing the bar down against and parallel to the sides of the block. Since the bar is held firmly at the top, the metal cannot free itself in any direction, and must therefore come from the die square and true. The section *D E* gives a clear idea of the amount of metal in the frame and block.

This machine is responsible for its existence to Superintendent of Motive Power Turner, of the Buffalo, Rochester & Pittsburg Railway, who has brought out many good things in tools operated by compressed air.

Time Necessary for Building a Locomotive.

There is an article going the rounds of the technical press about the rapidity with which a locomotive was built in a French railway shop. We have had many competitions of the kind in this country, and the impression was given that certain shops could build a locomotive in about twenty-four working hours. They may put an engine together in less than that time, and nearly all locomotive builders would undertake to do the work still more expeditiously if anything was to be gained by the performance. People should remember that there is a vast difference between building an engine from specifications and assembling the finished parts.

To follow the operations from the drawings is a tedious process. We believe that Baldwin's people turned out engines on their first great Russian order within four weeks after the order was given, and European builders wanted twice as many months.

It takes four pattern makers from six to eight weeks to make the complete set of patterns for a mogul engine. Two men will be ten or twelve days making the pattern for a cylinder and half saddle and all core boxes. Locomotive builders are very expeditious when they have an engine ready six weeks after the specifications have been received, especially with the diverse forms and special patterns now in vogue.

Our Insert.

The five queer-looking machines, shown in our insert, do not appear much like the modern locomotive, but they contained nearly all its essential principles, and they formed in brass and iron tentative steps that led to the perfected locomotive. All are native American except one, and give a good illustration of what this country was prepared to do without assistance in developing the locomotive.

For years before 1830 the belief was gaining followers that the development of America's system of inland transportation must be done by railroads, and the more advanced thinkers believed that these roads would be operated by steam engines. In 1828 several railroads were under construction, but the motive power to be employed upon them was not settled. Horatio Allen, a celebrated civil engineer in the employment of the Delaware & Hudson Canal Company, went to England in that year to purchase material for a small railroad the company were building, and he was authorized to purchase some locomotives if he considered their use practicable. The following year he brought back the "Stourbridge Lion," which was built by an engineering firm in England. It was taken to Honesdale, Pa., where it was tried. The engine worked satisfactorily, but was considered too heavy for the track, and was never used as a locomotive after the first trial.

At this time one of the most ambitious railway schemes in the world was the connecting of Chesapeake Bay and the Ohio River by means of a railroad, an enterprise which was pushed principally by citizens of Baltimore. Early in 1829 a few miles of this railroad, which is now the Baltimore & Ohio, was ready for service, and the question had to be settled, what kind of motive power should be employed. The famous trial of locomotives on the Liverpool & Manchester Railway had not yet taken place, and reports from England gave little encouragement to those who thought that locomotive engines would be the future motive power of railways. An enterprising citizen of Baltimore, the late Peter Cooper, however, determined to settle the matter himself, and he constructed a small engine to run on the railway. The thing was a failure at first, but he had it taken to a machine shop run by George W. Johnson in Baltimore. Among Johnson's men was an apprentice, named James Milholland, who was an ingenious youth. Milholland appears to have taken the lead in putting the tiny locomotive into practical shape, which was successfully done. When it emerged from Johnson's shop, the machine worked quite satisfactorily. It had an upright boiler, with tubes made of gun barrels.

Although this little engine was too small for doing useful, practical work, it demonstrated that a successful engine could be built for operating railway trains. Peter Cooper's "Tom Thumb," as it was called, was much smaller than Stephenson's "Rocket," but it contained all the elements of the "Rocket," and was built without the designer knowing anything about what Stephenson was doing. It weighed less than 1 ton, and on trial developed 1.43 horse-power. The idea of using tubes in the boiler was not new, that kind of boiler having been built many years before in this country by Nathan Read.

The Milholland boy, who did so much to put the Cooper engine into practicable shape, afterwards became superintendent of motive power of the Reading Railroad, and put the stamp of his ability more indelibly upon the American locomotive than any other man.

The first managers of the Baltimore & Ohio appear to have been intensely patriotic, for while those in charge of other railroads were arranging to import locomotives from England, the Baltimore & Ohio directors advertised that they would give a prize of $4,000 for the best locomotive of home manufacture. This brought out five competitors, and the prize was awarded to the "York," shown in our engraving, made by Phineas Davis, a watchmaker, of York, Pa. Another of the competing locomotives was built also by a watchmaker of Philadelphia. Davis followed Cooper's plan of using a vertical boiler. The engine weighed about three tons, and was the precursor of the vertical locomotives largely used by the Baltimore & Ohio in early days.

The "York" was not, however, the first locomotive built in the United States for practical service. On returning from Europe Horatio Allen entered the service of the Charleston & Hamburg Railroad, and designed for them the "Best Friend," which was built at West Point Foundry, N. Y. Allen adopted Cooper's idea of an upright boiler, but he did not use tubes. The heating surface was entirely in firebox, which had a conical crown, running nearly to top of the boiler. That engine went into regular train service, and was the first on the American continent to pull trains. It finally came to grief by the negro fireman holding down the safety valve to stop the noise of the escaping steam. After the resulting explosion, the horizontal tubular boiler was applied to the engine.

Among the competitors for the Baltimore & Ohio prize was one engine built by Wm. T. James, of New York, a most ingenious engineer. His engine, shown in our group, was built subsequently, and a celebrated feature about it was the link valve motion. The mechanical world did not then appreciate the value of that device, and it did not come into general use until it was reinvented in England and adopted by the Stephensons.

The best wood ever tried for railway ties is sapota, used to some extent for this purpose in Mexico. It is a tropical timber and is exceedingly durable for outdoor or indoor use, above or below ground. Pieces of this wood taken out of buildings said to have been erected over two centuries ago, show not the slightest indication of decay. In color it is nearly as dark as logwood and very heavy, and so hard that the boring of holes for spikes is very laborious work. It has a tendency to split if exposed to the heat of a tropical sun for a few months, and for this reason the sapota ties have to be well covered with ballast.

Many railroad people and travelers have marveled at the wonderful, the odd and the idiotic names given to Pullman cars. The secret has been revealed that the finding of names is assigned to a daughter of the car-building magnate, and that the young woman is engaged on congenial work when choosing silly names for the cars. She has lately selected for the new equipment of sleeping and dining cars on the Iron Mountain line, the following names: Dining car, "Quantzintecomatzin;" sleepers, "Chililitli" and "Nezahualcoyatl."

An Engine Register.

There have been a great many devices gotten up for the purpose of keeping an accurate record of the condition and location of power, and the general idea of the best of them has been based on pegs or blocks which carried a symbol to represent a certain state of things—good, bad or indifferent, as the case might be—arranged in a series of holes in a gorgeously decorated board.

On systems where 500 or more engines are in service, the flat board reaches proportions of no mean magnitude, sometimes covering the whole side of a room. In such a case it is no easy task to keep the record in proper shape, or gather the information required from it.

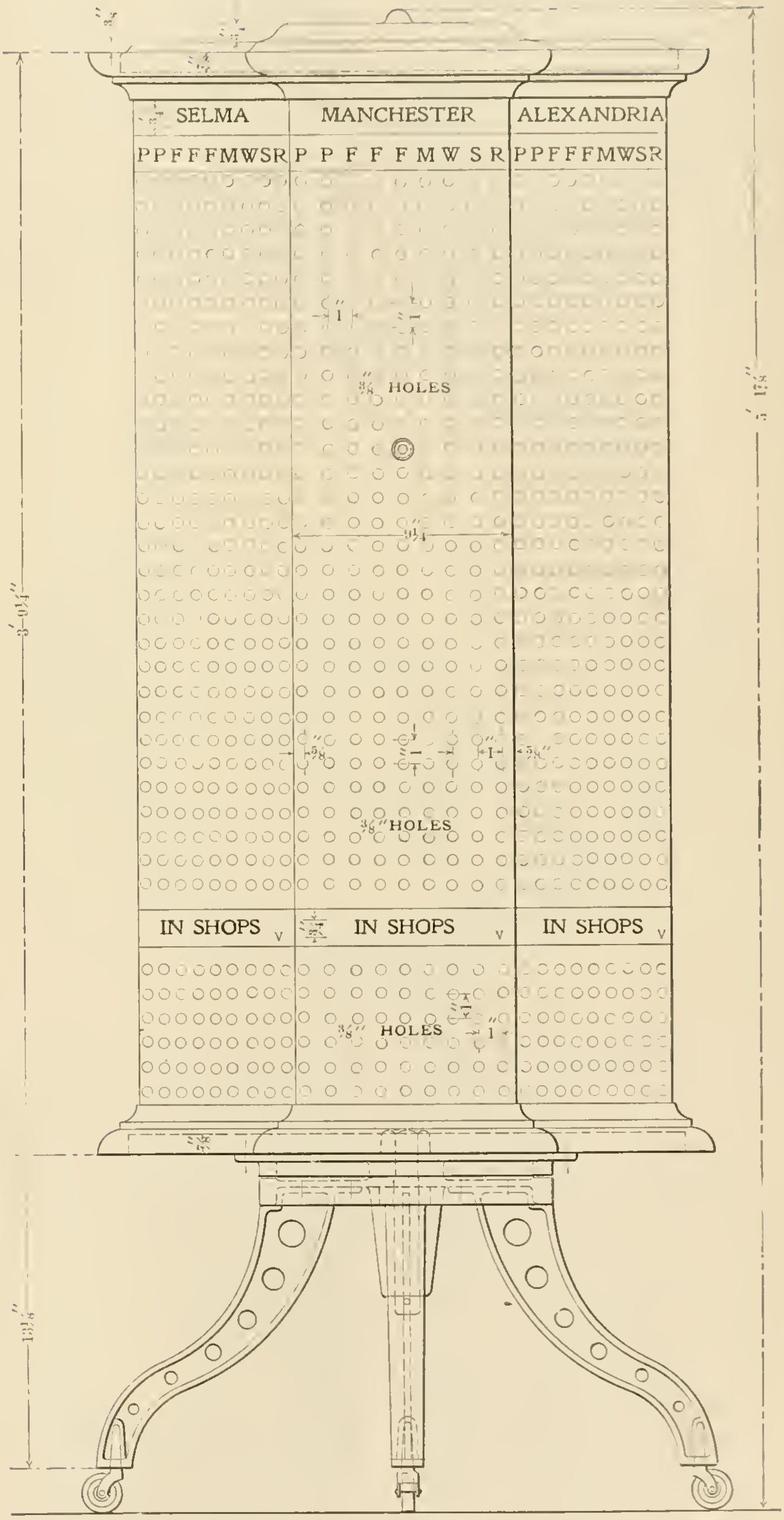
The register shown in the engraving is in the office of Superintendent of Motive Power Thomas and Assistant Superintendent of Motive Power Chapman, of the Southern Railway, at Washington, D. C., and was evolved by those gentlemen. It is octagonal in shape, 28 inches in its greatest width, and 62 inches high. Each perforated face is 9¼ inches wide by 36¾ inches high, and contains 324 holes for pegs, with a total of 2,592 on the eight faces.

At the top of each panel is found the division shop which that panel represents, and under it are letters denoting kind of service an engine is in—*P* indicating passenger, *F* freight, *M* mixed, *S* switching, *W* work, *R* reserve, and *V* vacant. On the face of each peg is a depression made to receive a pasteboard tag which is lined off into four spaces, the first of which indicates by *x x* the driver brake only, the fourth with *x* denotes driver and tender brake, the second has number of engine, and the third has size of cylinder. In addition to these characters on the face of the pegs, there are pasteboard washers, red one side and white on the other, showing bad or fair condition, and a blue washer has been added to signify a condition between fair and bad.

These are the keys to one of the most convenient engine registers we have seen. It is mounted on castors and swivels easily, so as to bring any division or set of pegs into view without the necessity of one leaving his seat. The two features of portability and small amount of floor space occupied by this register are its strong points. The designers of it have reason to congratulate themselves on the possession of a good thing, for it is a long way in advance of ordinary methods of keeping in touch with facts motive power officers have to deal with.

Railway Operating in Turkey.

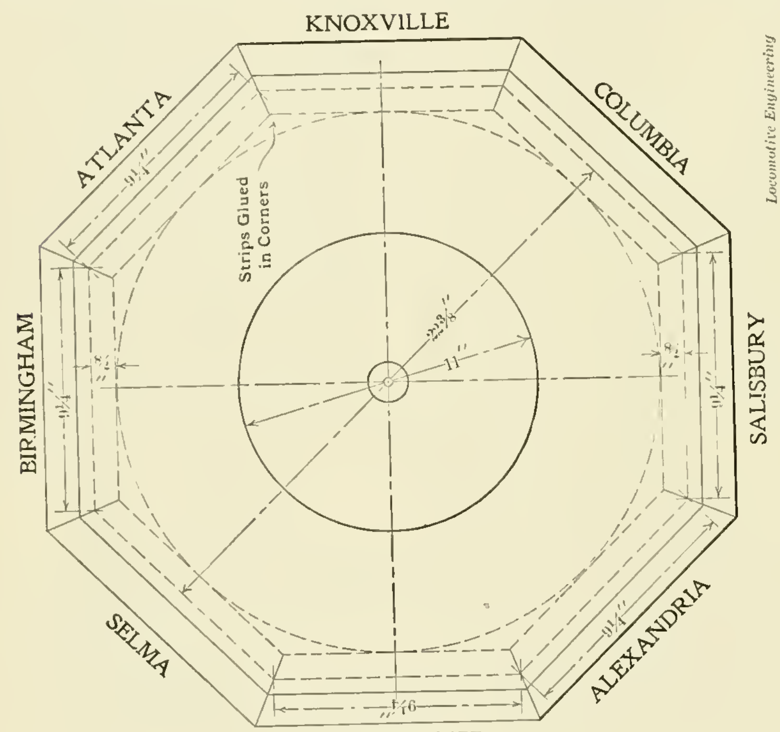
With all the confusion and misrule that prevails in Turkey, there are a great many flourishing industries in that country, and in some lines the people are peculiarly skillful in various arts. When necessity compels the people to carry on operations



ENGINE REGISTER. Fig. 1.

that have been forced upon them by the advances in Western civilization, they are found at their worst; but in such work as operating railroads, they follow exact and rigid methods which more progressive people might imitate to advantage.

According to Mr. Henry C. Finkelstein, who has been connected with Turkish railroads for some years, the total railway mileage in Turkey is now 3,123, the principal lines being from Constantinople to Bellova via Adrianople and Philippopolis, 562 miles; from Smyrna to Aiden, 507 miles, with branches in different directions. The discipline on the Turkish roads is stated by him to be very severe. Negligence is punished with heavy penalties, and if a collision occurs, all employés who share in the responsibility are likely



ENGINE REGISTER. Fig. 2.

to be sent to prison, and, if anyone is killed or injured, under sentences for long terms. Employés of the roads who are injured in service receive pensions, and if the injuries prove fatal, their families are provided for. The law requires railroad companies to provide for the families of persons who are killed on their lines by accident, and those who are injured receive compensation to cover their board, medical attendance and loss of wages as long as they are unable to pursue their accustomed avocations.

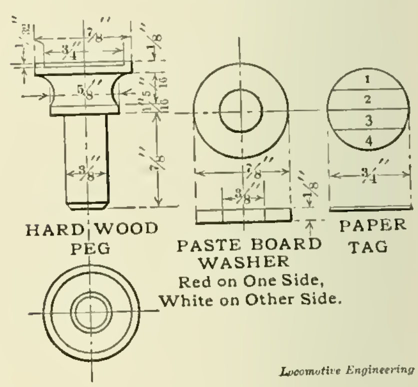
At the same time there is a penalty of $1 for walking upon a railroad track in Turkey, for every offense. Cattle and other animals found on the right of way of railways can be confiscated by the company, although the owner may redeem them by paying 25 cents each for sheep, dogs, goats, hogs and other small animals. It costs $2.50 to get a cow or horse out of a railway pound. Animals that are not ransomed within a given time are sold at auction for the benefit of the railway company, which, however, must return to the owner a sum in excess of the fine imposed by law and the cost of keeping the animal while in charge of the company. All articles left by travelers in the cars or in the station houses are also subject to similar rules. They can be redeemed upon the payment of a fee, and at the end of a certain period all articles not redeemed are sold for the benefit of the company.

Every passenger must be in his seat when the last gong sounds, a few moments before the departure of a train. Travelers buying tickets must present the exact amount of money to the ticket agent; otherwise he is authorized to charge a commission of 4 per cent. for making change, which goes into his own pocket. Local tickets are good only for the train for which they are sold, and will not be redeemed, but through tickets will be accepted on all trains within the limit of time indicated upon them. Children under three years of age travel free, and between three and seven are carried at half rates. All gendarmes, prisoners of state, policemen and other officials are carried at half fare upon the presentation of a certificate of identity. Army officers and soldiers are carried for one-third fare upon the presentation of an "ilmihaber" certificate. Soldiers traveling on duty for the Government are carried free upon the presentation of a "pestie" certificate.

Passengers found upon trains without tickets are required to pay three times the full fare between the place where they started and the first station reached after they are discovered, when they are allowed to buy a ticket for the rest of their journey at the regular rate. One hundred pounds of baggage is allowed for every ticket, but the traveler has to pay three cents for having his trunk checked. The Oriental express and trains from Constantinople to Vienna (44 hours) and to Paris (72 hours), run twice a week, and carry first-class parlor and sleeping cars. Similar trains run between Smyrna and Aiden.

Facing Valve Seats with an Air Motor.

At the Erie Railroad shops, East Buffalo, they have a little slide-valve engine with one cylinder, 1½ inches diameter and 4 inches stroke, that was designed by Master Mechanic Moore for facing valves. It is used to drive the valve-facing machine, on the plate of which it is mounted. Power is transmitted to the cutter by means of a spur gear on the engine shaft,



ENGINE REGISTER. Fig. 3.

meshing into a corresponding gear that drives the facing machine.

The engine, easily carried with one hand, is kept in the tool room until wanted for use either in the roundhouse or erecting shop, when it is quickly put in position on the facing machine, and piped to any air reservoir conveniently near; most generally that on the engine having the valve seats faced, if it is a roundhouse job. This little engine is economical in air consumption, being geared to the machine so as to cut off short and use the air with least waste, contrary to the conditions found in the air consumers generally used for light powers.

They are a great improvement in any event over the crank-and-elbow motor for which the facing machines were originally gotten up, and are a joy to the old-timer who looks back a few years to the period when he did this job, perched on a crazy foundation of blocking, and had to take a roughing cut with a hammer and chisel, on a hot engine, with a dreary prospect of file pushing ahead of him.

The Baldwin Locomotive Works have an order for one locomotive from the Chicago & West Michigan Railway.

Ancient Water-Tube Boilers.

The saying that "there is nothing new under the sun" has received a new illustration in discoveries made at Pompeii, of boilers, which seem to prove that the water-tube boiler, supposed to be a modern invention, was used by the people of Italy two thousand years ago.

In a paper by W. T. Bonner, Cincinnati, O., submitted to the last meeting of the American Society of Mechanical Engineers, several Pompeiian boilers, which are now in the National Museum at Naples, were illustrated and described. Two of the boilers have tube water grates, and the belief is that the tube surface was used for the purpose of accelerating the boiling of the water.

The boilers are all made of bronze, and are still in good condition. The boilers do not appear to have been subjected to much pressure above the atmosphere, and were used, evidently, for cooking purposes. They are all very elaborately ornamented, and are reinforced at the points where they would be liable to give out.

Coal from China.

It is rather startling to find that coal can be mined in China and sold in California at a profit. Several cargoes of coal from China have been imported into California, and it is reported to be of very good quality.

Those who are familiar with the coal market say that within a very few years the Chinese coal mines will supply the whole market of the Pacific Coast, except those portions where coal is found. The extremely cheap labor of China enables the coal to be brought to the surface at a very low price. The only obstacle to very active competition in this industry at present is the want of good transportation facilities in China. The extension of Chinese railways, which has begun very actively, is going to exert a very prejudicial effect on the coal-mining interests of the United States and Great Britain.

A reporter of a New York newspaper, who attempted to describe an accident that happened to a locomotive belonging to the Long Island Railroad through the breaking of a crank pin, involuntarily made a funny description. The mishap, he said, caused the cylinder head to blow out and the released piston flew round with such rapidity that it smashed the pump of the air brake. It also smashed the window on the side of the engine cab. Another reporter makes his description of the accident read: "The Patchogue express, over the Long Island Railroad, at 10,24 met with a slight accident at Winfield. The crank pin of the locomotive blew out and wrecked the part of the cab used by the fireman. Fireman Conklin was, fortunately, not in his seat at the time.

Apprentices in Railroad Shops.

Since the Master Mechanics' Association took upon themselves the work of investigating the condition of the apprentice boys, there has been a great deal of investigation and discussion of the subject, which is likely to do a great deal of good for our future mechanics. The apprentices in nearly all railroad shops have reason to be thankful to those who brought up the investigation of their condition, for it is certain that the interests of many of these young men have been very badly neglected, even in places where the highest kind of treatment might have been expected.

Since the subject has been thoroughly stirred up, we are certain that it is going to result in considerable improvement over existing practices. There are friends of the apprentice working in two lines for his benefit; one side of men propose that something more shall be done to give the apprentice the opportunity to learn his trade properly, and the other side proposes that he shall be given the opportunity to learn the scientific branches of his business.

Among the many expressions that we have seen recently regarding the condition of the apprentice, a report made by Mr. John Mackenzie, superintendent of motive power of the New York, Chicago & St. Louis, to the Central Railroad Club, seems to contain the most sensible and practicable views. He said that there are more applicants for the position of apprentice than it is possible for railroad officers to accept, and he was in favor of regulating the pay of apprentices by the work they were able to perform; ability and skill should be recognized and should be made an incentive to increased remuneration.

It is a well-known fact that where men are placed, for instance, on a lathe, and become proficient in handling that particular tool, they are often kept in that position for a long time. A practice of this sort is good for the employer, but it is not good for the workman, and apprentices should be changed from different tools periodically and given an opportunity to do all classes of work. It is a difficult matter to pass judgment, in many cases, as to the proper course to pursue in the changing of the boys, and from one class of work to another, as some of the boys learn much more readily than others and pay a greater attention to the work to be done. Upon his own progress and adaptability for the work to be done should depend to a great extent his advancement.

The tendency to require technical education for the apprentices leads up to the question: Have we not gone beyond the practical training of the apprentice, and is it the duty of railroad companies to train the boys as mechanical engineers? There are few people who consider that any such duty rests upon railroad companies, or any other employers of labor. The training of mechanical engineers ought to be a private matter, followed outside of railroad establishments. The tendency to specialize work makes it all the more difficult to give technical training to apprentices, or even the training that makes a good all-round mechanic. The piece-work system, which is growing every year, tends to make specialists, and it makes necessary some special system of education for workmen.

The easiest solution of this problem of training workmen as mechanics would be the selecting of good mechanics, who have the faculty of teaching, and make it their duty to impart to the boys a knowledge of the work to be done, and to see that they are kept on operations for which they were best fitted, so that it would be to the benefit of both employer and employé. The education which boys can obtain by attending night schools, drawing offices, testing departments, etc., open up great possibilities which will be embraced or neglected according to the tastes and tendencies of those most interested.

To Help in Reducing Fuel Bills.

The following circular letter has been sent by Mr. George F. Wilson, superintendent of motive power of the Chicago, Rock Island & Pacific, to all the engineers and firemen employed on the system:

"After January 1, 1897, a book published by Mr. Angus Sinclair, on 'Combustion and Smoke Prevention on Locomotives,' will be furnished to each engineer and fireman in the employ of these companies. It is expected that each man will study the contents of this book, as all master mechanics are instructed, after the expiration of ninety days, to examine engineers and firemen to ascertain if they have given the contents of the book attention. I believe you all realize that the locomotive fuel bill on a railroad is one of the most expensive items, and without proper care there is more waste in this than any other expense pertaining to a locomotive.

"We find there is as much as $1,000 per annum saved by some engineers and firemen over others where conditions are as nearly equal as it is possible for them to be, and the object in furnishing these books is to educate you to a higher standard of economy in the use of fuel.

"It is necessary for us to do this, because the rates received by railroad companies for doing business, and the high competition which exists, make it our duty to acknowedge a merit in good and economical men. All officers are watching this item of expense closer than ever in the history of railroads.

"We hope you will find the book profitable, as we are satisfied you will, none of us doing so well that it is not possible to make an improvement, and I think all of you will be able to do better after studying the contents of this book and applying yourself rigidly to its instructions. We are satisfied when this is done our company will get good results from you."

Spontaneous Combustion.

BY SAM SHORT.

The principal American cities have been suffering for some time from the labors of certain knights of peculiar industry who seem to think that arson, or starting fires that may commit wholesale murder, is an easy and fairly safe way of making a living. Detectives have been remarkably successful in identifying these pirates of law and public safety, and many principals in this line of bread-winning have been sent to institutions where the earning of meals will no longer be a cause of solicitude.

It is good for society that deliberate fire-raisers should be sent to penitentiaries for the remainder of their miserable lives, but there are left at large a set of imbeciles whose carelessness does almost as much harm as the deliberate crimes of the fire-raisers, and yet law and justice seem incapable of reaching them. The trouble is that people cannot be punished for being fools, and the fool in the long run is more dangerous than the knave.

Experiment has repeatedly demonstrated that a mass of cotton saturated with oil will in a short time generate sufficient heat to set the material on fire. There are many materials that moisture alone is sufficient to raise the mass to the igniting point. The act of a mass of this kind setting itself on fire is known as spontaneous combustion.

The writer was walking about a railroad car shop the other day, where most of the material within reach was of a highly inflammable nature, and he saw a mass of greasy waste which had been taken out of oil boxes, heaped up against a wooden partition. Naturally the thought occurred, "That is a dangerous practice," and the question was put to my escort; "Are you not afraid of fire starting from that mass?"

"Fire?" he exclaimed; "don't you see that this shop is heated by steam and lighted by electricity. Why, we don't permit anything in the shop that could possibly cause fire. Can't afford it. See the valuable cars we have got in the shop all the time."

"Did you never hear of spontaneous combustion?"

"Spontaneous combustion? Seems to me I once read about a ship taking fire with that. It is something about gases and chemistry, and I don't know anything about these things."

"Did you never hear that a heap of greasy waste would soon generate sufficient internal heat to start a fire?"

"Never heard of such a thing, and don't believe it. I have been a shop foreman for twenty-one years, and I never knew a case of greasy waste putting itself on fire. It is against Nature, and is one of the silly ideas that you theoretical people are annoying practical men with. Spontaneous combustion is one of your brain troubles."

I did not argue out the case; but as we walked pensively through the far-reaching scrap heap, a stumble over a dilapidated oil box roused me from a reverie about the benefit it would be to people at large if the fool-killer would make the rounds of railroad shops a trifle more frequently.

Traveling Air Lifts in Shop Economy.

It has come to be well understood that there are very few openings in a manufacturing or repair shop that yield a better return for the investment than a well-equipped compressed-air outfit. This fact is so well established for most industrial plants that it is not our purpose to extol any imaginary schemes, but we want to emphasize the beauties of some that are a good thing in a locomotive shop.

Among these may be mentioned the crane that is mounted over the erecting pits and parallel to same, as installed in the Chesapeake & Ohio shops at Richmond, Va. These cranes are operative both transversely and longitudinally, and are of the simplest possible construction, consisting of an air lift 6 inches in diameter and 7 feet long. The cylinder is mounted on a small carriage rolling on a light 9-inch I-beam which spans the pit; the I-beam is also mounted on wheels and has a movement the whole length of the engine. All bearings are of the roller type, making the crane remarkably easy to handle.

In situations where the crane can be carried on the chord of the roof-truss, as it is in the case under consideration, there can be no cause for a "kick" on the score of expense, when it can be shown that a few months' use will return every dollar put into it.

For handling stacks, cabs, sandboxes, dome-caps, frames and steam and exhaust pipes, these cranes are sure to come under the head of indispensable tools after the first experience with them. This has been the record at the Richmond shops, under the charge of Master Mechanic T. S. Lloyd, who has a Pedrick & Ayer belted compressor to supply his wants.

One other instance equally as good from a money-saving standpoint, is that of the air traveling crane in the brass foundry of the Huntington shops, presided over by Master Mechanic A. F. Stewart. An always-behind state of affairs in this foundry led to a few improvements that gave the men an opportunity to do work. The output of 43,000 pounds of brass per month, as turned out by the hand method of wrestling with the crucibles, was, by a few well-considered improvements, almost doubled, running up to 83,000 pounds—and this is done with practically the old force.

The improvements comprised a new floor, a traveling crane that would lift a crucible from either furnace and convey it to any part of the floor, together with some minor details, all looking to the comfort of the men. The crane is of the simplest character, home-made—only a small air cylinder made to roll on an overhead rail; but it furnishes another object lesson in what can be done cheaply by air when brains are backing the proposition.

In furnishing these master mechanics of the Eastern and Western divisions of the Chesapeake & Ohio road with the means to compress air, Superintendent of Motive Power Morris has shown considerable acumen, and will be certain to get his reward in the shape of a reduction in operating expenses that will prove the wisdom of the move.

Machinists' Small Tools.

The small economies made necessary by the pressure of hard times appear to have revived, to a great extent, the practice of machinists making their own small tools. The manufacture of machinist's small tools has been so highly perfected by specialists, and the price at which tools of that kind are sold is so low, that no man can really afford to do the work for himself; but there are still a good many men to be found in leisure hours laboring away at the production of tools of this kind.

Some notes written by Chordal for the "American Machinist," several years ago, on this subject are still of living interest. He said: "Machinists are always hankering after nice little tools, and I have often wondered why in the world they do not have them. A fellow will go to work on a 4-inch try-square with the best of intention, perhaps, to have the finest square that the eyes of man ever beheld, something better than the square you buy, you know, something worth having. He works about thirty noons on this thing, and a few nights and a little on Sunday, and takes a half-holiday to finish it, and when it is done, it is simply a very awkward common tool, which no man of judgment would willingly pay him 75 cents for. It is as square inside as he can file it, and it is as square outside as he can file it, but it is not particularly square in any other way. The finish is decidedly bad, and in many places has destroyed the accuracy of the rougher filling. If the man is silly he will be proud of this square, and will carry it away from the shop in his pocket for two or three weeks, in order to exhibit it evenings to men working in other shops; and then he will put some fancy notches in his toolbox to hold the thing, and it will be some months before he will become fully aware of how common a job this square really is. If he is a tolerably sensible man he will begin to slouch it when it is about half done, and finally get disgusted and give it to some apprentice boy as a keepsake. If he is a really sensible man he will quit making it before he ever thinks of beginning it, and will buy a decent hardened square with a day's wages. It will be square any way you take it.

"A home-made straight-edge is another abomination. It is ugly and crooked—two fatal qualities in a straight-edge.

"The average machinist always insists on making his own inside and outside calipers. It takes a good deal of time to make a pair of 9-inch inside calipers, and they are never a really creditable job, no such tools as our machinists ought to have, but they are all right as calipers. They are true on the joints and the points are all right, and they will go into a small deep hole and all such as that, but still there is that peculiar home-made ugliness about them, which is not a matter to be proud of."

Discipline Without Suspension.

Mr. G. R. Brown, general superintendent of the Fall Brook Railway, sends us the following list of roads that have adopted the Fall Brook system of "Discipline Without Suspension." We understand that there will be a meeting of all the superintendents of the Erie system soon to discuss the desirability of adopting the Brown system. The probabilities are that they will vote to adopt it, as several of them are personally warm admirers of the plan.

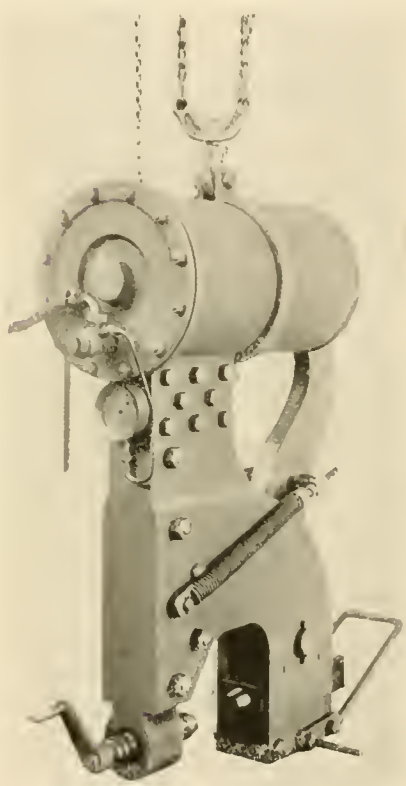
Louisville & Nashville; Pittsburg, Cincinnati, Chicago & St. Louis; Corning & Painted Post Street Railway; Wabash Railroad Company; Columbus, Sandusky & Hocking Valley; Plant system; Canadian Pacific Railway; Kanawha & Michigan Railway Company; Toledo & Ohio Central; Kansas City, Fort Scott & Memphis; Chicago & Alton Railroad; Missouri, Kansas & Texas; Chicago Great Western; Chicago & Northwestern; Columbus, Hocking Valley & Toledo; Boston & Maine; Detroit, Lansing & Northern; Chicago, Peoria & St. Louis; Norfolk & Southern; Chicago, Rock Island & Pacific; Toledo, St. Louis & Kansas City; Flint & Pere Marquette; Southern Pacific; St. Paul & Duluth; Lehigh & Hudson River Railroad; Chicago & Eastern Illinois; Minneapolis, St. Paul & Sault Ste. Marie Railway; Columbus, Shawnee & Hocking Valley Railroad; Duluth & Winnipeg; Burlington & Missouri River Railroad; Peoria & Pekin Union Railroad; Chicago & West Michigan; Wheeling & Lake Erie; Duluth & Iron Range.

Pneumatic Riveter.

We are indebted to Mr. Reuben Wells, superintendent of the Rogers Locomotive Works, for photographs of the pneumatic riveter here illustrated. Mr. Wells writes us:

"As per your request, I inclose photographs of two views of my pneumatic riveter, designed for putting in the mud ring rivets of locomotive boilers. The boiler is, of course, turned bottom side up within reach of a swinging crane. In our case the boom of the crane is 20 feet long, made of a 12-inch I-beam, with a trolley and a chain hoist. The following are the dimensions of the main parts:

Diameter of cylinder—16 inches.
Stroke of piston—23 inches.
Leverage—7 to 1.



WELLS' PNEUMATIC RIVETER.

Stroke of die bar—3¾ inches.
Range of screw—7 inches.
Pitch of screw—1 inch.
Diameter of screw—3 inches.
Between dies, maximum—11 inches.
Center of die to top of gap—10½ inches.
Weight—2,000 pounds.
Hose—1-inch, 4-ply.

"The riveter is carried by a swinging crane, a trolley and a worm-geared 2-ton chain hoist. A pressure of 80 pounds per inch gives a pressure on the rivet of 112,000 pounds. The motion of the die holder is parallel, the screw is turned by hand, with or without the crank handle, so as to take up all unnecessary slack between the dies and the rivet ends previous to applying the power. The air is applied by turning the handle to a horizontal position, and exhausted by turning it back to the vertical position. The piston and lever are brought back to their normal position by the coiler springs. The die holder follows the movements of the lever. All important wearing parts are of case-hardened hammered iron. The plates forming the sides are of 1¾-inch steel; the post between them holding the screw nut and main lever, and the links connecting it to the sleeve-shaped piston are of wrought iron; cylinder and piston of cast iron; piston packing, leather. The outer end of cylinder is open and has a shoulder to prevent the piston from passing out. The dies in the end of screw and die bar are changeable, and held in position by a 1½ inch diameter shank entering the end of the screw and the die bar, and secured by cotters. The handle shown is for the purpose of adjusting and holding the machine in position.

"The machine is in daily use, and seems to answer its purpose perfectly. An air gage is used for showing at all times the pressure in the hose and air pipes. Rivets can be driven as rapidly as they will cool sufficiently to allow the pressure to be released."

The emery wheel, which is such a useful tool in nearly all shops where grinding has to be done, is a comparatively new-comer as a rival of the grindstone. In 1842, one Henry Barclay patented in Great Britain an emery wheel which was made of Stourbridge clay and emery, the mixture to be pressed in molds and then baked to a bright red heat. That wheel was not a success, but from the day the patent was issued there were tentative attempts made in England to improve the emery wheel. American mechanics were, however, the first to make the emery wheel a decided success, and nearly all the valuable improvements effected upon it have been carried out in the United States.

A patent has been granted to Lewis S. Proctor, of Sheffield, Ala., for a reversible rail. The idea is to get a rail the life of which will be doubled. With this design, when one of the wearing surfaces has been pounded out of shape by the passage of heavy trains, the rail is simply released from the bed-plates and reversed. An entirely new surface is then presented. It is curious to read about an "invention" of this kind being patented in this year of grace. The rails of all early European railways were double-headed, the idea being that they could be turned when the first head was worn out. It was found in practice that the chair wore grooves into the head placed first beneath, and these grooves made such a rough-riding track that turning of rails was abandoned after a very few years' experience with the plan.

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Education of Railroad Men.

For many years after railway operating began, the men in charge did not consider that knowledge or intellectual training was of any special value as a recommendation for those who applied for employment. In fact, one of the most celebrated pioneer railway managers in England used to argue that entirely illiterate persons made better trainmen than those who could read and write. There never was this prejudice in favor of ignorance in the United States, but there was little objection to the employing of illiterate men, until sad experience had demonstrated, by many a fatal collision, that a man who could not read train orders was not a safe person to employ in train service.

In the pioneer times, the fact that a man was strong enough to twist a brake wheel, or to throw wood or coal into the firebox of a locomotive, was regarded as a satisfactory indication of efficiency. As time wore on, and the teaching of experience became properly recognized, railroad managers came to understand that facts concerning the successes and the failures of the earlier generations of railway men ought to be useful information for their successors. The facts and data concerning the experience of one generation, put into book and pamphlet form, became the text-books by which their successors could obtain safe guidance. For the last twenty years there has been a growing tendency to exact educational tests from the men who were candidates for promotion, and the treatises concerning the experience of former railway men form the text-books on which examinations are based. There was long an inveterate prejudice against book-instructed railroad men; but like every prejudice founded upon ignorance, it is rapidly disappearing. To-day "higher education for railroad men" is a demand expressed in many quarters, and philanthropists and educational establishments are urging forward a crusade with these words as the watch-cry. Up to the present time, most of the agitation has been confined to talk, but the work has been earnestly begun in some quarters.

There are few educational establishments that have attracted so much attention as that drawn to the engineering department of Purdue University during the last few years. This attention has been principally aroused by the fact that the institution is educating a department of its students in special lines of railroad work which have never been undertaken by any educational establishment before. That there is a demand for the special instruction of railroad men has been apparent for years, and the Purdue University has been the first to undertake the work in a practical manner.

The authorities of several universities have been considering for some time the advisability of introducing a regular railroad course into their curriculum, and we have no doubt that within a very few years young men will graduate in the railroad profession, just as they now graduate for medicine, law and divinity. The friends of higher education for railroad men are very hopeful of the beneficial results to be secured from special university education. No doubt, many of the men who are the leaders in railway affairs at present suffer from the want of early special educational training; but there are greater difficulties encountered in making a special educational course applicable to what might be called the railroad profession than there is to any other. When a young man graduates in law or medicine, he has learned enough of the profession to begin business in a tentative fashion; he is able to make a decent living from what he has learned. A young man graduating from a course of railroad science is not likely to be acceptable for any position except a low one, which few college graduates would care to accept. So much of success in railroad work depends on practical experience that special training must necessarily be of little use unless experience in doing actual railroad work is added to it. A young medical practitioner or lawyer may walk on the edge of starvation for the first year or two, but he is not required to do uncongenial menial work. A graduate in the principles of railroad management, in spite of the high title he may receive from a university, must begin practical work as a clerk, fireman or brakemen, and his education tends to unfit him for the hard work to be performed.

The tendency of the higher educational establishments is to fit men for being officers rather than workmen, and the training tends to make them think that experience in the ranks is not necessary. Some very successful railway managers have commenced at the top, but their success was due to extraordinary ability and quickness of perception. The ordinarily successful railroad man has risen from the ranks, and by the experience gained, rising step from step, has acquired the qualifications which made him successful. Special college training will make a man more useful in railroad business if he goes through the same practical experience as ordinary railway men have to undergo; but unless he is satisfied to do that, his school education will be of little advantage. Graduates of engineering schools are rapidly coming to the front in mechanical departments of railways at the present day, but those who are succeeding are men who were not afraid to don overalls and learn the details of the mechanical trade after they had graduated from college. Most of the engineering graduates refuse to do this, and they drop into minor positions, as draftsmen and clerks, and they are rarely ever qualified for the higher positions.

While we consider that the movement to give college instruction to railroad men to be highly commendable, we think greater benefit to the greater number might be performed in a different way. The vast majority of railroad men drift into the business after they have passed their majority, and have become railroad men through circumstance rather than through a purpose followed from boyhood. We think that the most practicable way to elevate the educational standard of railway men would be, to give those in service assistance in educating themselves, and the encouraging of studies that will supply required information in the lines which the men are going to follow. In the industrial countries of Europe there is a vigorous movement going on to supply the means of technical education for workmen, and every facility is given to ambitious workmen to study the scientific part of their business. Something of this kind has been going on in a few American cities; but the movement drags slowly, because it seems to be no person's particular business to urge it forward. It ought to be made the business of the States, just as much as primary education is now, and the educational training of railroad men ought to be part of it.

The men who educate themselves after entering railroad service are those likely to reach the higher positions eventually, because the fact that they labor on self-instruction shows that they possess the kinds of qualities which push men above their fellows. What is most urgently needed is the providing of better means to help the men who are striving to help themselves.

While there is undoubtedly agitation going on in favor of the educating of railroad men, we do not think that railroad officers, as a rule, show much favor towards the better educated men found in the ranks. The selecting of men for promotion has not usually been dictated by an effort to find the most intelligent men, or even the men best adapted to perform the duties required. Personal favor is nearly always the force that starts a man from the ranks to a higher position. If he has not the natural capabilities to perform higher duties, he will fall back into the ranks again; but when he fails, no greater care than before will be exercised in finding men of superior training.

We know the particulars of one case, where ten young men, about fifteen years ago, joined together to form a firemen's lodge. They were all ambitious and naturally of studious habits. All of these men are alive to-day, and only one of them is performing railroad work, and he is running an engine. The others are all in outside professions, and all are highly successful. There is no doubt but any one of these men would have made a highly successful railroad officer, and would have been a credit to the business; but not a single one of them was selected by the officers of the road for advancement, or saw the least indication that they would ever rise above the position of locomotive engineer, no matter how long they might remain with the company. This is merely a specimen of what is going on in various parts of the country to-day. The crying want of railroad life is not for the importation of higher-educated men from the outside, but the exercise of a little more inclination on the part of those in power to help forward the men who have educated themselves.

The Roundhouse Foreman.

We are not aware that there is any position in railroad service where the compensation received is so small, in proportion to the importance of the duties performed, as that drawn by roundhouse foremen. A roundhouse foreman, even at a very important point, is generally paid about the same as a freight engineer. He must be an engineer himself to perform his duties satisfactorily; and unless he is a machinist, the different problems that are daily and hourly imposed upon him to settle will be left to the final settlement of a breakdown, with all the expense and delay that such an accident involves.

Besides the duty of providing engines for all trains promptly, and crews for all engines, the roundhouse foreman is the physician who has to diagnose the complaints of all locomotives, without having the equivalent of a pulse or coated tongue to aid him in deciding what is the probable malady. About the most common report made on the work-book of a roundhouse is "Engine not steaming." There are numerous defects that may prevent an engine from steaming, but the engineer gives no indication of what may be the particular trouble, and the roundhouse foreman must proceed to make changes or adjustments on the lines, which experience has taught him are the most likely to effect a remedy.

An engine is reported to have a pound on, say, the right-hand side; the engineer cannot tell to a certainty where the pound is, but he thinks it is in the driving boxes; the driving boxes are carefully examined, the wedges and main-rod bearings are thoroughly tried, and nothing can be found that is likely to cause the pound complained about. The engine goes out again without the trouble being remedied, and on returning, the same complaint is made, and likely enough the observant roundhouse foreman finds it was caused by a flat spot on one of the tires, or he may have exhausted all his ingenuity in looking at parts that could be examined or tried in the usual way, and finds out after the engine has been steamed up to go out on next trip that the trouble is a loose piston head.

Another source of worry to the hard-worked roundhouse foreman is reports about injectors and air pumps not working properly. Some engineers habitually neglect their feed-water strainers, and report injectors not working properly, when nothing is the matter but a trifling obstruction to the water, which could be remedied in a few minutes by intelligent attention.

Some men appear to have continual difficulty with their air pumps, yet are never able to give an intelligent report of what is the matter. The air-brake schoolmaster is pretty widely abroad in the land at present, and we think that his work ought to result in the establishing of a rule that no engineer should be allowed to make the report "Pump not working properly." He ought to be familiar enough with the apparatus to indicate what is the matter.

The increasing number of locomotives equipped with solid-ended rod connections has done much to reduce the work on rods; but the report "Lost motion of rods to be taken up" is by no means a thing of the past. An eight-wheel engine, with the rods properly put up and the wedges kept in shape, ought to run at least 50,000 miles before anything has to be done to the side rods; but many engineers seem to think that something ought to be done every month, and they make the life of the roundhouse foreman a burden, with their orders that lost motion should be taken up. Another fertile source of annoyance to this overworked official is hot boxes. Some engineers never think of having cellars packed until the box begins to run hot; then the bearing gets cut, and the packing of cellars has to be attended to every trip until the bearing gets back to its normal condition.

Besides the worry of keeping the engines in good running condition, a great many roundhouse foremen are constantly under fire of engineers and firemen, who are troubled about not getting their rights, or are anxious to obtain rights which belong to others. When a man covets a particular run, it is wonderful the amount of ingenuity he will sometimes display in bringing up evidence to show that the run belongs to him, though everyone else is satisfied that he has no right to it. When a man of this sort fails to get anything which he wants, the roundhouse foreman is blamed for being unjust, and he has to carry the burden of abuse and hatred, because he is doing his best to do justice to all around. In many cases the roundhouse foreman is used as a buffer between master mechanic and the enginemen, and all disagreeable duties are put upon him, while the pleasant actions go to the credit of his superiors.

We used to believe that the position of a brakeman of a freight train, when the car roofs are covered with ice and the wind blowing like a myriad of knife-blades, was about the most disagreeable position we could imagine; but, on calm deliberation and actual experience, we rather think we would prefer the position of brakeman to that of roundhouse foreman at a place where there are few engines to do the work properly and the engine men are indifferently under control.

The Benefits of Shop Kinks.

The progress of shop practice in the use of special tools, known as kinks, is well illustrated in this issue. The Lehigh Valley Railroad having contributed the greater portion of them, the attention of those interested will be attracted in the direction of that road, and to the management of a machinery department that gives evidence of a correct understanding of shop needs and how to provide for them.

One of the best proofs that the publication of these short cuts to reduce cost of work, are working a revolution in shop expense, is seen in the great strides made in the application of compressed air, a field that bids fair to keep the inventive faculties well sharpened in conjuring up new schemes by which to harness it to new uses.

This interchange of practical ideas among practical men is a good thing from any point of a shop view. When encouraged, as it should be, it serves to bring out the best there is in a man, incites all to renewed efforts, and gives the fellow with no capital except a healthy brain, an opportunity to get to the fore that he would be unlikely to reach by any other means. It is simply the quiet working of the law of the survival of the fittest.

In our wanderings among railroad shops in pursuit of something new for these pages, we often find some tool under construction that is being put up from the dimensions furnished by our engravings, with slight modifications, perhaps, to meet certain local wants, but the tool in its essential particulars would be copied, thus paying tribute to some man's head work. And this, too, by men who were not copyists, but who were the authors of many good things that someone else wanted, and were quick to recognize merit wherever found.

The lesson of this is that a spirit of emulation properly fostered is a producer of net results. We know of no better way to accomplish these than for the heads of machinery departments to offer a premium for the best and cheapest methods of getting out work. Such a course would have the effect of snuffing-out the incompetents and putting to the front those properly entitled to advancement.

The Mechanical Engineer.

A mechanical engineer with a good shop training is perhaps one of the best-paying adjuncts of the machinery department of a railroad. He is rightly regarded as an institution that ought to be cultivated, and many a motive power officer in full sympathy with the worth of that individual has at some time in his career had visions of what he would be able to accomplish if the required appropriation were forthcoming.

The endless round of important details that are handled in the mechanical engineer's office only go to emphasize the wisdom of its installation, since, if it were not made, these identical details would never receive attention, and would suffer in consequence. This is an infallible test of a most convincing character; it will have as much weight with the guards of the strong box as anything that can be said in its behalf. All opposition quickly disappears when proof is available that the mechanical engineer's office is a paying investment, and not until then in most cases, for it is a cold-blooded business proposition, without the remotest semblance of sentiment; a statement true for all cases except where "pull" is involved.

There is one disagreeable phase of this subject, seen in the attitude of many corporations which can well afford the expenditure necessary to have first-class talent, but which will dishonestly force a draftsman to perform the duties properly belonging to the mechanical engineer, and at a miserable compensation; the while falsely holding out to him specious promises of preferment in order that he may not quit the job that he is too poor to abandon. To those draftsmen who have had to play the dual role (and they are legion), this appears to be the very essence of contemptible meanness.

Among the other influences at work to prevent the organization of a technical auxiliary to the machinery department, is the widespread fear that it will be the entering wedge for so-called luxuries that are likely to follow in its train; among which the most prominent are a testing plant and a chemical laboratory. While these are certainly a good investment on a large road, they are not absolutely necessary to the small one. The live mechanical engineer will manage to save more with their help.

That the railroad mechanical engineer has a future, there is no doubt. The results shown by roads which are run on broad-gage lines, are the best guaranty that his mission in the machinery department is coming to be recognized. These results are object lessons to doubting managements, and are more potent than any appeal from the head of that department, because they are bespangled with the sign of the dollar.

Drip from Car-Heating.

In our correspondence department a railroad trainman directs attention to the annoyance, expense and delay caused to railroad companies by the drip from the pipes of car-heating apparatus. From what we have seen in connection with steam-heated trains, it seems to us that our correspondent has treated the evil very mildly. We have never seen anything connected with railroad operating where more senselessness was displayed than in the locating of the drip pipes from car-heating apparatus. Experience has taught most men who have charge of locomotives to exercise as much care as possible to prevent leakage from cylinder cocks and feed pipes from falling upon the rail. These men have learned that wetting the rails in front of the driving wheels causes wasteful slipping, and that water poured upon the rail behind the drivers fills the flange spaces with ice in frosty weather and greatly increases the resistance of trains that follow.

But this department of dearly earned experience does not seem to have radiated itself in the smallest degree to the men who have charge of cars. They have permitted the car-heating people to dispose of the water of condensation as best suited their convenience, and several of the most popular systems drop the water upon the rail, or as near to it as they can locate the drip cock. It seems incredible that this condition of affairs has escaped the notice of the railroad officers who are responsible for the prompt movement of trains, and who are presumably interested in preventing anything likely to materially increase the cost of train movement. We would rather refrain from lecturing practical railroad men about their duties, but we are moved to urge all concerned to pay some attention to where the drip from car-heating pipes finds its goal. This is a minor detail thoroughly worthy of attention.

Variable Exhaust Nozzle.

In another part of this issue we publish a letter concerning a successful variable nozzle which is now in use on the Duluth & Iron Range and other railroads in the Northwest. A peculiar feature about the form of variable nozzle described is that the operating mechanism is connected with the reverse lever, and consequently is always used.

There have been a great many variable nozzles invented, to be put into service a short time and then dropped. The reason of this has been, not that the variable nozzle is not a good thing, but that the appliance would be neglected for a day or two, and then when the engineman tried to operate it, the parts had become so much gummed up that they could not be moved.

We do not believe that any minor improvement of a locomotive could produce so much saving of fuel as the regular use of a good variable nozzle. The serious objection to a fixed nozzle is that it is too small at the time when the engine is working hardest, and produces too strong a suction on the fire, while the same steam opening is at times too small for good production of draft when the engine is working lightest. The plan adopted by the designer of the variable nozzle we are referring to, is that it opens to its maximum area when the engine is working hardest and closes up when the engine is working lightest. This can be easily adjusted to make the engines steam freely at any point of cut-off, at the same time reducing the force of the exhaust action at the time it is most destructive upon the fire.

Adhesive Weight vs. Weight on Drivers.

A misnomer that is now so strongly intrenched in our mechanical vocabulary as to be, and is regarded as the correct thing, is the so-called "weight on drivers." The universal acceptance of the term is that it represents the adhesive or frictional weight on the rail, but, as a matter of fact, the weight on drivers is literally the weight resting on the journals of those wheels, and *not* the weight on the rails under the wheels. Here is a state of things that is likely to befog the average mind not up in locomotive technics.

The weight of two pairs of cast-iron driving wheels 62 inches in diameter, with the eccentrics and straps on the main axles, will be 12,000 to 14,000 pounds, and it is not necessary to say that this is all adhesive weight, since it rests on the rail. If we accept the standard expression, "weight on drivers," as correct, we virtually deprive the engine of 12,000 to 14,000 pounds that ought to be in use to hold her to the rail.

"Weight under the drivers," which would be understood as the reaction of the rail against the weight on and in the drivers, would be preferable to the existing style of reference. "Adhesive weight" is sometimes used, and we think properly, for the reason that it tells at once what it is for, and we have no difficulty in understanding that it is the total weight on the rail under the drivers, and that its function is to enable the engine to move on the rail, which it could not do without the friction between the wheel and rail due to this weight.

It is about time that some of these misapplied mechanical terms were relegated to a side track having a derailing attachment. "Weight on drivers" ought to go.

Attempt to Stop the Tide of Progress.

There has been a somewhat curious agitation going on among New York, New Haven & Hartford brakemen. It appears that it has been the habit of that road to employ five brakemen on freight trains; but since the general introduction of the air brake on freight cars, the men are not required for braking purposes, and only four are now employed. The brakemen are agitating in favor of bringing the question before the Legislature of Connecticut, for the purpose of getting laws passed that will compel the railroad company to revert to the old practice of employing five brakemen on each train.

The men who are engaged in this agitation might as well agitate against high tides rising over the low lands on the coast of Connecticut. The tide of progress says that before many days the occupation of brakeman on freight cars will be gone, just as certainly as it is now gone on passenger trains. Trainmen will be needed for switching purposes and for the protection of trains; but the word "brakeman" will have no more meaning, as applied to practical work, than the word "plate-layer" has to-day as applied to trackmen in the British Isles.

Seeking Positions Abroad.

In his very interesting letter on "Russian Railways" that appears in the first portion of this paper, Mr. McCarroll gives some salutary advice to American railroad men who are striving to obtain positions on railroads abroad. He tells that there is no opportunity whatever for men who cannot talk the language, and that the hours are longer and the pay much smaller than that paid by American railroads.

We have repeatedly in these columns told American railroad men that they cannot better their condition by going abroad, but we seldom mention any new railway enterprise in foreign countries that we do not receive inquires from trainmen about how they should proceed to obtain a position on the railway mentioned; this, too, from men who have good jobs. To these men we would again declare emphatically that there is no country on the globe where trainmen are so well paid and so fairly treated as they are on American railroads. In other countries the pay is lower, the working hours longer, and the treatment from superiors is harsh as compared with our standard, and frequently brutal. To those who are dissatisfied with railroad life in this country, and intend going abroad, we would say—Don't. Rather turn to farming or working on the track; you will find it more comfortable.

Report of Traveling Engineers' Convention.

We have received the report of the proceedings of the Fourth Annual Convention of the Traveling Engineers' Association. It is a volume of the standard size and contains 258 pages, and is well got up in every particular. The reports and discussions upon them are excellent, and are noted for their practical common sense and absence of all fads and foolishness. The discussions are particularly good and represent the views of men who have something of value to say and know how to say it. It is a long time since we looked over a report which contained so much matter that we would like to select for the pages of "Locomotive Engineering." We cordially recommend the report to people who like to read good engineering literature. It can be obtained from Mr. W. O. Thompson, Secretary, at Elkhart, Ind.; price 50 cents.

Nearly all the leading railroad companies in the country have purchased for the mechanical department, decimal gages to be employed for measuring sheet iron, tubes and wire; but the men in charge do not seem to be making much use of the gage. In the course of last month we had a conversation with a tube maker, and he acknowledged that he had not yet received one order for tubes with the dimension of thickness indicated according to decimal measurement. The railroad mechanical men in this country have in their hands the effecting of a great reform in a line of measurement where great confusion now prevails. It is to be hoped that they will not permit the opportunity to pass, through indifference or carelessness.

We have received from Professor Magruder, of the Ohio State University, a bulletin concerning the engineering education to be received at the Ohio State University. We judge from the bulletin that the university authorites are following an extremely comprehensible system of engineering education, and that their plan of admission is arranged so that anyone desirous of higher engineering education can obtain it without difficulty. The great obstacle which mechanics, as a rule, find in entering engineering schools, is the difficult preliminary examination to be encountered. The Ohio State University has a system of short courses which students are admitted to without any entering examination. We do not have space to give the whole of the bulletin, but we earnestly recommend young men who have aspirations for a sound engineering education to send for it to Professor Magruder. The engineering tuition at that institution is free, and unusually good provisions are made to enable students to earn a livelihood while attending the university.

There is talk of the Chicago, Burlington & Quincy system undertaking a novel business of newspaper publishing, the printing office to be carried on a train, and all the station agents on the road to be turned into local reporters. It is a pretty scheme, and no doubt originated with some minor official, hankering after notoriety as an editor. The hard-headed management of the system are not likely to spend the company's money on any such crack-brained enterprise. There are too many railroad companies engaged in doing business their charters do not entitle them to pursue, but publishing a pretentious daily paper would be carrying illegitimate business too far. It is difficult enough for men trained to the business to make daily papers pay, and amateurs would make failure certain when their operations were carried on on a large scale.

An earnest effort is making by a combination of railroad managers to induce Congress to extend the time for the compulsory equipment of cars with air brakes and automatic couplers. Unless this extension is granted, the time allowed expires with this year. The unusually hard times that have prevailed since the law was passed offers a valid reason for asking an extension of time, but it seems to us that the demand for five years' extension is not reasonable. Some railroad companies have done their best to be prepared to comply with the law when it becomes due, while others have done little or nothing, and it has not been the poorest lines which have done least. We believe that the most equitable course for Congress to pursue would be to permit the law to be suspended for a certain time, at the option of the Board of Interstate Commerce Commission, and that the board should have authority to deal with individual cases on their merits

PERSONAL.

Mr. F. H. Dehn has resigned the position of master mechanic of the Texas Central.

Mr. A. H. Smith has resigned as master mechanic of the Middle division of the Grand Trunk, on account of failing health.

Mr. J. D. Evans, foreman of the Peoria & Pekin Union shops at Peoria, Ill., died in the latter city on January 16th, aged 57 years.

Mr. W. H. Fry, formerly superintendent of the car department of the New York, New Haven & Hartford, died recently at St. Louis, Mo.

Mr. J. A. Fillmore, manager of the Pacific system of the Southern Pacific Railway, is seriously ill with pneumonia at San Francisco.

Mr. P. T. Mooney has been appointed master mechanic of the Texas Central at Walnut Springs, Tex., taking the place of Mr. F. H. Dehn.

Mr. H. K. Gilbert, auditor of the Crane Company, of Chicago, up to January 1st, has been elected treasurer of the Sargent Company, Chicago.

Mr. E. W. Knapp has resigned as master mechanic of the Mexican National, to accept the position of master mechanic of the Inter-Oceanic-Puebla Railway.

Mr. Wm. W. Noble has been appointed purchasing agent and paymaster of the Huntingdon & Broad Top Railroad, with headquarters at Philadelphia, Pa.

Mr. William Bullock, engine dispatcher on the Long Island Railroad at Long Island City, has been promoted to be roundhouse foreman at the same place.

Mr. Curtis W. Shields has accepted the position of New York representative of the Pedrick & Ayer Company, of Philadelphia. His headquarters will be at 111 Liberty street.

Mr. S. D. Warrener has resigned as mechanical engineer of the Lehigh Valley Coal Company, to take effect February 1st, to accept a position with the Calumet & Hecla Coal Mines.

Mr. H. C. Smith, master mechanic of the Delaware and Hudson Canal Company at Oneonta, has resigned and has been succeeded by Mr. J. R. Skinner, who was formerly foreman.

Mr. C. E. Doyle and J. M. Gill, superintendents of the Eastern and Western divisions of the Chesapeake & Ohio, respectively, have had their titles raised to general superintendents.

Mr. Frank S. Gannon, prior to his leaving the Staten Island Rapid Transit road, of which he had been general manager, was presented by his employés with a silver service, valued at $1,000.

Mr. R. W. Ryan, who is so well known to railroad men in connection with reporting conventions and club meetings, has opened a stenographer's office in the Post Office Building, New York.

Mr. Chas. A. Cole, formerly foreman of the Wiggins Ferry Company, has accepted the position of roundhouse foreman with the St. Louis & San Francisco Railway Company at St. Louis.

Mr. C. A. Thompson has been appointed the representative of the Standard Steel Works in St. Louis and the Southwestern territory. His headquarters are at 615 North Fourth street, St. Louis, Mo.

Mr. Elmer W. Brown has been promoted to be traveling engineer on the Susquehanna division of the Erie. Mr. Brown has risen rapidly, and made his mark first through high efficiency as a fireman.

Mr. G. A. Woodman has been appointed superintendent of the car department of the Lima Locomotive & Machine Company, Lima, O. He was formerly with the Illinois Central Railroad.

Mr. John Commerford, who on January 1st entered the service of the Chicago & Northwestern as master car builder, has had an experience of twenty-five years in the car department of the Pan Handle road.

The position of master of machinery of the Pittsburgh & Lake Erie has been abolished, Mr. L. H. Turner's title being changed to superintendent of motive power and equipment, at McKee's Rocks, Pa.

Mr. Frank E. Barnard, so well known to railroad men in connection with his work for B. M. Jones & Co., has been admitted a partner into the firm. We congratulate both the firm and Mr. Barnard, but more especially the firm.

Mr. W. D. Trump, assistant to the general manager of the Flint & Pere Marquette, has been appointed assistant superintendent of that road, with headquarters at Saginaw, Mich., succeeding Mr. W. F. Potter, resigned.

The numerous railroad men who were acquainted with Mr. George H. Eager, treasurer of the Crosby Steam Gage & Valve Company, will be sorry to hear that he died in the early part of last month, after about three weeks' sickness.

General Manager W. M. Greene, of the Baltimore & Ohio Railroad, has appointed Mr. J. M. Graham, superintendent of the Ohio division, *vice* J. Van Smith, as general superintendent of the Trans-Ohio division, with headquarters at Chicago.

Mr. George A. Hancock, superintendent of machinery of the Gulf, Colorado & Santa Fé has been appointed to the position of assistant superintendent of machinery of the Atchison, Topeka & Santa Fé, with headquarters at Topeka.

Mr. George Royal, Jr., has resigned his position as Western agent of the Sterlingworth Supply Company, to enter that of the Nathan Manufacturing Company. His office will be with his father, whom he will assist in working the Western field.

Mr. Henry L. Morrill, ex-second vice-president and general manager of the St. Louis & San Francisco, received, as a New Year's present from the employés of that road, a gold-headed cane as a mark of the high estimation in which he is held.

Mr. W. E. Symons, formerly a master mechanic on the Atchison, Topeka & Santa Fé, has accepted a position with the Galena Oil Company, with headquarters at Savannah, Ga. He will have the Plant system of railroads for his territory.

There is an official announcement that Mr. E. R. Reynolds, having resigned as general manager of the Long Island Railroad, the officers who have heretofore reported to him will now report direct to President W. H. Baldwin, Jr., at Long Island City, N. Y.

Mr. J. S. Coffin, for many years one of the popular representatives of the Galena Oil Company, has been appointed assistant superintendent of the mechanical expert department of the Galena Oil Works, Limited, appointment taking effect January 1, 1897.

Mr. James C. Currie, a well-known passenger engineer on the Pennsylvania Railroad, has resigned to enter the service of the Nathan Manufacturing Company, with headquarters in New York. He takes the place made vacant by the death of the late W. H. Gurney.

Mr. Wm. Gibson, who recently went from the "Big 4" to be assistant to the general manager of the Baltimore & Ohio, has been promoted to be assistant general superintendent of the Baltimore & Ohio lines west of the Ohio River, with headquarters at Baltimore, Md.

It is announced that the private office of Mr. George L. Bradbury, vice-president and general manager of the Lake Erie & Western, has been removed to room 623 Monadnock Building, Chicago. His office for ordinary business will remain at Indianapolis, as heretofore.

The Queen of England always makes New Year's Day notable by conferring titles upon persons who are considered worthy of such honors. Among those who were favored last New Year's Day was William Birt, the general manager of the Great Western Railway of England, who was made a knight.

Mr. W. R. Stirling, of Chicago, who resigned the position of first vice-president of the Illinois Steel Company a year ago, to take charge of the Universal Construction Company, has now resigned and gone to Europe. He expects to travel several months, and it is his intention to go into other business on his return.

Mr. M. E. Ingalls, the well-known president of the Cleveland, Cincinnati, Chicago & St. Louis, who is also one of the strongest personages politically in the Middle States, has entered a protest with the Ways and Means Committee of Congress against increasing the tariff on railroad supplies, such as iron and steel.

Mr. H. B. Hodges, late superintendent of tests of the Southern Railway, has been appointed purchasing agent and superintendent of tests of the Long Island Railroad. Mr. Hodges' connection with the Southern Railway, as superintendent of tests, dates from October, 1895, and he held a similar position previously on the Baltimore & Ohio.

Mr. C. G. Geddes, who has been general manager of the Toledo, Bowling Green & Fremont road ever since its inception, has tendered his resignation to take effect January 1st. It is thought the Maumee Valley road and the Bowling Green will be consolidated under one manager. Mr. Geddes has several offers under consideration from corporations that run into Toledo.

Mr. Wm. Smith has been appointed superintendent of motive power of the Duluth, Missabe & Northern Railway, to succeed Mr. A. F. Priest, with headquarters at Duluth, Minn. Mr. Smith was for several years superintendent of motive power of the Chicago & Northwestern. He has been idle for two or three years, and we are glad to welcome a first-class mechanic like Mr. Smith back into the railroad fold.

Mr. Jacob Johann, who has for years been a prominent figure among railroad mechanical men, has retired after being in harness for fifty years. Mr. Johann has been one of the most successful men in his line during his long course of service, and retires to a well-deserved rest and leisure with the good-will of a large number of railway men and other friends. We trust he will long be spared to enjoy his pleasant home at Springfield, Ill.

Mr. H. Monkhouse has been appointed superintendent of machinery of the Chicago & Alton, with headquarters at Bloomington, Ill. Mr. Monkhouse has for several years been assistant superintendent of motive power of the Chicago, Rock Island & Pacific, in charge of the Western divisions and of the shops at Horton, Kan. Mr. Monkhouse is a graduate of the Baltimore & Ohio, and has been with the Rock Island for eight years.

A circular issued by Vice-President and General Manager Ramsey, of the Wabash, announces the appointment of James Bruce as chief inspector of fuel and locomotives. The employés hitherto known as road foremen of engines on the various divisions will in the future have the title of division inspectors of fuel and locomotives, reporting to Mr. Bruce, and he in turn to the vice-president and general manager. Mr. Bruce's headquarters will be at St. Louis.

One of the first actions taken by Mr. W. H. Baldwin, Jr., when he became president of the Long Island Railroad, was to find out the cause of the discontent which prevailed among the employés of the system. He found a rather savage system of discipline in force, men being punished with very little investigation of whether they deserved punishment or not. This has now been changed, and the Brown System of Punishment without Suspension established on that road.

Sir Jos. Hickson, for many years general manager of the Grand Trunk Railway, died at Montreal, Can., on January 4th. He became general manager of the Grand Trunk in 1874, after a long experience in other railway positions. He was born at Otterburn, Northumberland, England, in 1830. While a young boy he entered the service of the Northeastern Railway of England, and there received his baptism in the troubles of railway operations. He was a capable and able railway officer, as his career from the start up to the time of his demise clearly shows.

At the annual meeting of the Central Railroad Club, held in Buffalo last month, the following officers were elected for the ensuing year: President, John MacKenzie, superintendent of motive power, Nickel Plate; Vice-President, John S. Lentz, superintendent car department, Lehigh Valley; Secretary-Treasurer, Harry D. Vought, railroad editor of the "Courier." Executive Committee—A. M. Waitt, master car builder, Lake Shore; E. D. Bronner, assistant superintendent of motive power, Michigan Central; E. A. Miller, master mechanic, Nickel Plate; J. R. Petrie, joint inspector.

Mr. John Hickey, whose resignation of the office of superintendent of motive power, machinery and rolling stock of the Northern Pacific Railway, was the result of ill-health occasioned by the loss of four children in quick succession, was surprised at his home on the evening of January 9th by the master mechanics, general foremen of his road, and his office force, who sprung another surprise on him by first reading a handsomely engrossed testimonial, and afterward presenting him with a diamond stud and ring. The latter is a massive one, and unique, the top representing the front view of a locomotive. A large diamond does duty for the boiler, and two smaller ones for the cylinders, while still another stands in the place occupied by the headlight. From long associaion with the gentleman, we know that he is worthy of any mark of esteem from his subordinates, and that the fire from their precious gifts is not warmer than the affection they bear their late chief. Mr. Hickey has left for the South to find that rest and return of health he sadly needs. We hope his recovery will be rapid, so that he can again be at the front in locomotive engineering.

EQUIPMENT NOTES.

The Wabash are said to be getting out specifications for new locomotives.

The Live Poultry Company are getting some new cars built for carrying poultry.

It is said that the Mexican Central will order over 500 freight cars of different classes.

The reports are renewed that the Missouri Pacific are about to order a lot of new cars.

The Canadian Pacific Railway is wiring all new passenger train cars for electric lighting.

The Chicago & Eastern Illinois are to order some new coal cars—not less than 300, it is said.

The Ensign Manufacturing Company are building one car for the Canda Cattle Car Company.

The Colorado Midland Railway has ordered 180 freight cars from the Pullman Car Company.

The Michigan Peninsular Car Company are building some cars for the G. H. Hammond Company.

Two hundred gondola cars will be built by the Pittsburgh, Ft. Wayne & Chicago Railway at their shops.

A number of new cars are being built by the Atlanta, Knoxville & Northern Railroad at their shops.

The Brooks Locomotive Works are building one locomotive for the St. Marys & Southwestern Railroad.

It is said that Armour & Co., of Chicago, have ordered 200 cars from the Wells & French Company.

After a long shut-down, the Youngstown Car Company, of Youngstown, O., have started up their works.

The Baldwin Locomotive Works have delivered five ten-wheel engines to the Colorado Midland Railway.

It is said that the Marietta & North Georgia Railroad are about to order 500 freight cars of different kinds.

The Union Pacific has prepared specifications for fifty coal cars of 40,000 pounds capacity, having 36-inch gage.

The Union Pacific, Denver & Gulf Railway is having 100 new coal cars built by the St. Charles Car Company.

The Erie Car Company are building some cars for the Nichols Chemical Company and others for G. W. Arper.

The Pittsburgh Locomotive Works are building two locomotives for the Cleveland Terminal & Valley Railroad.

The Wells & French Company are building 150 freight equipment cars for the Atchison, Topeka & Santa Fé.

The receiver of the Colorado Midland Railroad will, it is said, be shortly in the market for twenty refrigerator cars.

Two hundred new box cars have been

recently built at the Ft. Wayne shops of the Pennsylvania Railroad Company.

The Pullman Car Company have twenty-five box cars under way for the Portland & Rumford Falls Railroad in Maine.

The Union Pacific, Denver & Gulf Railway have received six new locomotives from the Baldwin Locomotive Works.

The Jackson & Sharp Company are building two passenger equipment cars for the Jamestown & Lake Erie Railroad.

Two locomotives have been ordered from the Pittsburgh Locomotive Works by the Cape Fear & Yadkin Valley Railway.

The Osborn-Saeger Company are reported to have ordered 125 cars from the Youngstown Car Manufacturing Company.

The Chicago, New York & Boston Transportation Company are building twenty-five refrigerator cars at their Elgin shops.

The Schenectady Locomotive Works are building three locomotives for the Texas Midland and two for the Fall Brook.

The Universal Construction Company, of Chicago, are building ten steel flat cars for the Chicago, Lake Shore & Eastern Railroad.

The St. Louis & San Francisco Railway has ordered 300 coal cars of 60,000 pounds capacity, from the St. Charles Car Company.

The Schenectady Locomotive Works have received an order for five locomotives from the Midland Terminal Railroad Company.

The Union Car Company are building seven freight equipment cars for the Lackawanna Live Stock Transportation Company.

Murray, Dougal & Co., are building four freight equipment cars for Efros C. Co. and four freight cars for the Eagle Cotton Oil Company.

The Seaboard Air Line people are getting out specifications for twelve new locomotives. They will be ten-wheel engines, similar to the last received.

The Bangor & Aroostook Railroad are receiving their order of 150 new flat cars, built by the car works at Berlin, N. H., at the rate of from 25 to 50 per day.

The United States Metallic Packing Company, of Philadelphia, have purchased the Dean sanding device for locomotives, and will handle it with their other specialties.

The Nippon Railroad of Japan has ordered 44 engines from the Baldwin Locomotive Works, the order being equally divided between freight and passenger engines.

A contract has been awarded the Missouri Car & Foundry Company for the building of 1,000 cars for the Fairport Dock Company, by the Baltimore & Ohio Railway.

An order has been placed with the Richmond Locomotive Works by the Cleveland, Cincinnati, Chicago & St. Louis and Chesapeake & Ohio railways for six locomotives.

The Cornwall & Lebanon Railroad has given an order to the Lebanon Manufacturing Company to equip 200 recently repaired freight cars with air brakes and automatic couplers.

An order for ten locomotives has been placed by Southern Pacific Railway, five of which will be built at the Cooke Locomotive Works, and five at the Schenectady Locomotive Works.

The Weimer Manufacturing Company, of Lebanon, Pa., are to build sixteen steel cinder cars for the Edgar Thompson Works; these cars are to be used for hauling cinders and slag from furnaces.

The export agents of the Bloomsburg Car Works, H. C. Dayton & Co., of New York, shipped during December, 1896, sixty-four freight and four passenger cars to Central America and South America.

The Charleston & Western Carolina Railway has made a contract with the Ohio Falls Manufacturing Company to build for the former, eighteen passenger and baggage cars, ten caboose and 375 freight cars.

The Pullman Palace Car Company are building four combination passenger and baggage cars for the Southern Railway. These cars will run on the Washington & Southwestern vestibule limited trains, and will be ready for delivery by February 15th.

Barney & Smith are building one freight equipment car for Barnum & Bailey; two passenger equipment cars for C. P. Huntington; two passenger equipment cars for the Jamestown & Lake Erie, and 100 freight equipment cars for the Kansas City, Pittsburgh & Gulf.

Three 30-inch gage locomotives have been completed at the Baldwin Locomotive Works for the Mapimi Railroad on the Mexican Central system. They are made to run by cog or by adhesion, at pleasure, and weigh 28 tons. The fireboxes are put in at an incline corresponding to the 6 per cent. grade they are to run on.

In the description of "First-class Gage Testing Appliances" in our December, 1896, number, we innocently referred to the weighted testing apparatus as an "Ashcroft" device, when it should have read "Crosby." While this excellent gage tester is so well known that all would recognize it from our engraving, simple justice to the manufacturers of it demands a full explanation. It is made by the Crosby Steam Gage & Valve Company, Boston, Mass.

The Big Four's Fast Run.

The Cleveland, Columbus, Cincinnati & St. Louis people are feeling proud these days, all on account of an extraordinarily fast run made from St. Louis to Cleveland with a special. Besides a sheet sent us by the general traffic manager, giving particulars, we have received seven letters about the run, so there seems to be a fairly widespread desire that "Locomotive Engineering" should convey the news of the trip to the uttermost parts of the earth.

The train carried the Geisha Opera Company, and consisted of five cars, weighing 351,000 pounds, exclusive of passengers and baggage. Eight-wheel engines with cylinders 18½ x 24 inches, driving wheels 68 inches diameter, and boiler giving 1725.6 square feet of heating surface, pulled the train from St. Louis to Indianapolis, a distance of 262 miles. The run from Indianapolis to Cleveland, 283 miles, was made by eight-wheel engines having cylinders 18 x 24 inches, driving wheels 62 inches diameter, and 1,600 square feet of heating surface.

The entire run of 545 miles was covered in 11 hours 18 minutes. With delays in actual stops deducted, the time used in running was 9 hours 55 minutes. From that it will be seen that the 545 miles were run in 595 minutes, an average of 55.38 miles per hour.

The greatest speed was attained between Mitchell and Comstock, on St. Louis Division, 3 2-10 miles in 2¾ minutes, or 76.3 miles per hour; Gays to Mattoon, 12 miles in 10 minutes or 72 miles per hour. On Cleveland Division, Marsh's to La Rue, 3 7-10 miles in 3 minutes, or 74 miles per hour; Wellington to Grafton 11 1-5 miles in 9½ minutes, or 69.7 miles per hour.

The train was handled by the following trainmen:

St. Louis to Mattoon, Engine No. 188. Engineer Cale Kirby, Fireman Arthur Krohn, Conductor F. M. McClelland.

Mattoon to Indianapolis, Engine No. 197. Engineer Frank Presler, Fireman H. L. Bauer, Conductor F. M. McClelland.

Indianapolis to Bellefontaine, Engine No. 110. Engineer J. D. Caskey, Fireman Thos. Robinson, Conductor E. A. Orr.

Bellefontaine to Cleveland, Engine No. 115. Engineer J. W. Kunkel, Fireman F. E. Fowle, Conductor Wm. McGraw.

The Chicago & Northwestern mechanical department have been engaged lately in making a series of tests on their stationary testing plant of compound and simple locomotives to demonstrate the relative value of the two forms of engines.

The Central Railroad Club, at last meeting, changed their constitution, making it the duty of the Executive Committee to elect the secretary and treasurer.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Two-Pipe Air Brake System.

For the benefit of those who are partial to double-pipe air brake systems, and who do not know that this ground has been gone over thoroughly, we are illustrating a form patented by Mr. Geo. Westinghouse, Jr., as far back as 1873, which is probably the simplest one of that type. As will be seen, the system can be operated either as straight air or automatic at will of the engineer, either form of brake being automatically cut out at will by the engineer. Auxiliary reservoirs can be recharged while the brake is set. It will also be seen that the double-pipe system was considered as far back as the triple valve itself; but the inventor recognized the disadvantages of such a system, and wisely confined his attention to the development of the single-pipe system. In his patent specifications, Mr. Westinghouse describes his device as follows:

"My present invention relates to an improved construction of the valves and pipe couplings employed in such apparatus.

"I will first describe my improved construction of valves, referring to Fig. 1, which represents a section of the valve-box. This valve-box has three chambers or compartments, and is provided with three valves, *A*, *B* and *C*, united by one stem. The first or upper chamber communicates, by the end passage *E*, with the pipe by which compressed air is conveyed throughout the train, and, by the side passage *F*, with the auxiliary reservoir of compressed air. In this chamber there are two valves, *A* and *B*, on the same stem of which the upper valve *A*, has a greater area than the lower valve, *B*, and has holes through it near its periphery covered by a disk *a*, pressed against its back by a spring. The second chamber communicates, by a side passage *G*, with the brake-cylinder, and the third chamber has an opening *H* to the atmosphere. This third chamber contains the third valve *C*, also on the same stem, which can close upward against a caoutchouc or leather seating *c* when the valve *A* is closed against its upper seat. The seating *c* is made with a little space between its inner edge and the body of the valve-box, so that when the valve *C* bear against it the pressure of air above the seating shall press it against the raised annular edge of the valve *C*, and thereby insure the tightness of its closure.

"The operation of these valves is as follows: Assuming that the auxiliary reservoir is not charged with compressed air, when compressed air is admitted into the air-pipe it enters by the passage *E*,

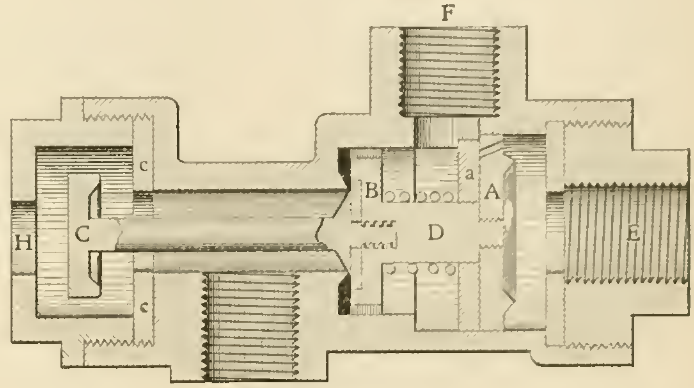


Fig. 1

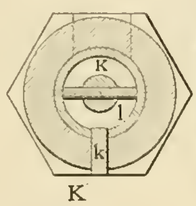


Fig. 3

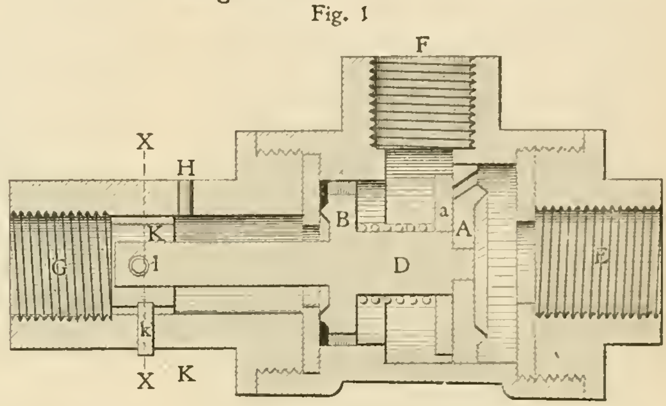


Fig. 2

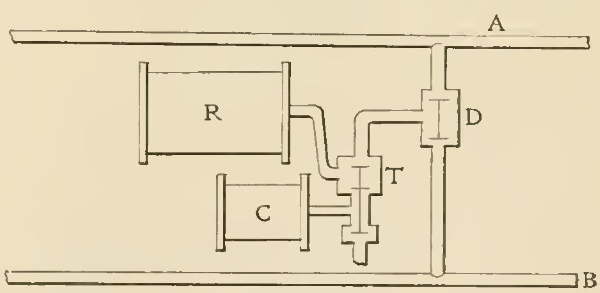


Fig. 4

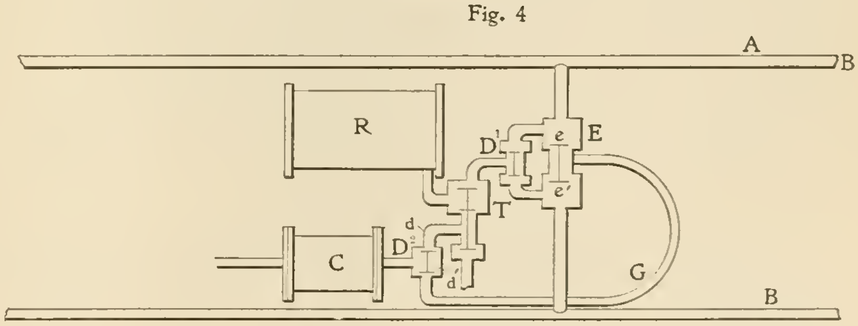


Fig. 5

EARLY DESIGN OF AUTOMATIC RECHARGING SYSTEM OF AIR BRAKE.

and, its pressure acting on the larger valve *A*, opens it and closes the valve *B*. The compressed air thus admitted flows through the holes in the valve *A*, pressing away the disk *a* that covers them, and, by the passage *F*, to the auxiliary reservoir, which it charges. At the same time the valve *C*, being on the same stem with *A* and *B*, is opened, and air from the brake-cylinder issues, by the passage *G*, past the valve *C* and through the opening *H* to the atmosphere; so that the brakes are taken off by relieving the piston in the brake-cylinder from pressure.

"If now it be required to put on the brakes, air is allowed to escape from the air-pipe, either by opening a cock or valve by hand or automatically (in the manner described in the specifications referred to above), when the air-pipe or its connections give way, or when a carriage becomes detached or runs off the line. The auxiliary reservoir having been charged with compressed air, as described above, the pressure communicated through the passage *F* acting on the larger area of the valve *A*, and finding no escape by the holes in its periphery, which are closed by the disk *a*, raises that valve against its seat, and so closes communication with the air-pipe by the passage *E*. At the same time the valve *B* is opened, and the valve *C* is closed. Compressed air then flows from the auxiliary reservoir by the passage *F*, past the valve *B*, through the passage *G* to the brake-cylinder, where it acts on the piston so as to put on the brakes.

"Thus, by means of this triple-valve arrangement, when the air-pipes communicating with *E* are charged with compressed air the auxiliary reservoirs are charged and the brakes are taken off, and when air is discharged from the air-pipes, the brakes are put on by the action of the air stored in the auxiliary reservoir.

"Fig. 2 represents a section of a construction of such a valve-box in which the lower disk-valve *C* is replaced by a sliding-ring valve *K*. In this case the opening to the atmosphere is a side passage *H*, and the communication to the brake-cylinder is by the end passage *G*.

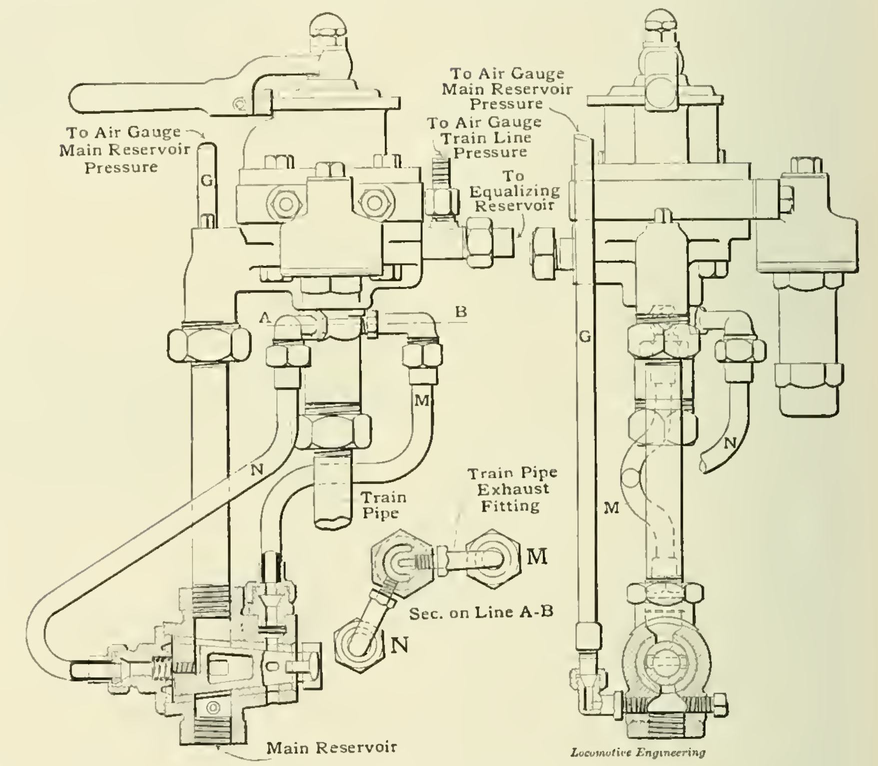
"Fig. 3 represents a sectional plan on the line *X X*. The ring *K* acts as circular slide, which closes the opening *H* when the valve *A* is seated, and leaves it open, as shown in Fig. 2, when the valve *B* is seated.

"The ring is divided at one side to allow it to spring so as to make an air-tight fit in the cylindrical part of the valve-box in which it fits, and a steady-pin *k* projecting into the slit of division, prevents the ring from turning round. The ring is connected to the valve-stem by a pin *l*, passing through the sides of the ring and the stem. The action is in this case the same as that described with reference to Fig. 1.

"I have described the action of this valve arrangement as if it communicated with only one air-pipe. By combining it, however, with double valves connected by a stem, such as have been described in the specifications above referred to, either or both of the duplicate air-pipes serve to work upon the auxiliary reservoir and brake-cylinder, as above described.

"By referring to the before-mentioned specifications it will be seen that these double valves are of two kinds; one which opens the passage from the pipe or higher pressure and closes the passage to the pipe of lower pressure, and the other which closes the passage from the pipe of higher pressure and opens that to the pipe of lower pressure.

"In connecting the duplicate air-pipe with the valve-box above described, and



IMPROVED STOP COCK—CLOSED POSITION.

with the brake-cylinder, such double valves may be arranged in the manner shown in the diagram plan, Fig. 4. In this diagram *A* and *B* represent the two air-pipes, communicating throughout a train; *R*, the auxiliary reservoir; and *C* the brake-cylinder. *T* is the triple-valve arrangement, above described, and *D* is one of the double-valve arrangements described in the specification above referred to, whereby either of the pipes *A* or *B*, that contains air at lower pressure than the other, is cut off. It will be seen that compressed air conveyed along either or both of the pipes *A* and *B* will operate on the auxiliary reservoir *R* and the brake-cylinder *C* by means of the triple-valve arrangement *T*, in the manner above described.

"Sometimes it is desirable that either of the two communicating air-pipes may be employed to charge the reservoir, while the other pipe may be used to operate the brakes. An arrangement of valves for this purpose is shown in the diagrammatic plan, Fig. 5, where *A* and *B* represent the two air-pipes; *C*, the brake-cylinder; *R*, the auxiliary reservoir; *T*, the triple-valve arrangement, above described; D^1 and D^2, double valves, such as that marked *D* in Fig. 4; and *E*, one of the other kind of double-valve arrangements, described in the former specification referred to above, whereby the pipe containing air at higher pressure is cut off from communication.

"From this arrangement it will be seen that one of the pipes—such as *A*—may be employed to charge the reservoir *R*, the compressed air from *A* passing by the one end of *E*, and past one of the valves in D^1, acting on the large valve in *T*, so as to open it and the farthest valve, and close the middle valve of *T* to the reservoir *R*. At the same time the other pipe *B* may be charged with compressed air for putting on the brakes, the air from that pipe passing the open valve *e'*, and thence by the pipe *G* to the valve-box D^2, where it will open the valve *d'* and close *d*, and thence to the brake-cylinders *C*, where the pressure will act on the piston so as to put on the brakes. If, now, the pipe *B* be relieved of pressure, then, the valve *e* being closed and *e'* being open, the air in the pipe *G* will have its pressure reduced. The valves *d d'* will then be in equilibrium, allowing the air from the brake-cylinder to escape past either or both of them, and either past the third valve in *T* to the atmosphere, or by the pipe *G* and past the valve *e'* to the discharge-pipe *B*. Again, assuming the reservoir *R* to have been charged with compressed air, and the pipe *B* to be relieved of pressure, by relieving the other pipe *A* of pressure the brakes will be put on, for the valves in *E* and D^1 being then in equilibrium the pressure is taken off the large valve in *T*, which is therefore closed, opening the second valve in *T* and closing the third, so that compressed air will flow from *R* past the open valve in *T*, and opening the valve *d* and closing *d'* into the brake-cylinder *C*."

Improved Cut-Out Cock.

We illustrate this month an improved form of cut-out cock designed by the Pennsylvania people, which is placed in the main reservoir pipe, and, when closed, permits the second engineer on a double-head train to make the emergency application, should it be needed.

When the cock is closed, the main reservoir pressure is cut off, and is registered, as usual, on the red hand of the gage, through pipe *G*. Train pipe pressure is registered on the black hand through pipe *N* and cut-out cock. Pipe *M* is thrown into disuse. Train-pipe pressure can only be discharged through the emergency ports, as the outlet at the angle fitting is piped to the cock by pipe *M*, and is there blanked.

When the cock is open, pipe *N* is thrown into disuse by being blanked, and the pressure released by the equalizing piston through the angle fitting passes freely through the opening in the small end of the plug to the atmosphere.

A close inspection of the cock as shown in the cut will make its construction and operation clear.

The use of dummy couplings for hanging up air-brake hose on freight cars has been abandoned by the Southern Pacific Railway. The company will hereafter receive freight cars at interchange points without "dummy couplings," and will decline, on and after January 1, 1897, to receive bills for replacing or repairing such couplings.

An air-compressor plant for shop work has been put in at the Union Pacific Railway shops at Cheyenne, Wyo. It will be used for operating machine tools, yard derricks, car cleaning, etc. Similar plants will be put in at the other principal divisional points. So says an exchange.

A good test of brake shoes could be made by ascertaining in how short a distance the train could be stopped, instead of testing for long wear or large mileage made. Perhaps a compromise between these two tests could be advantageously arranged.

CORRESPONDENCE.

An Automatic Retaining Valve.

Editors:

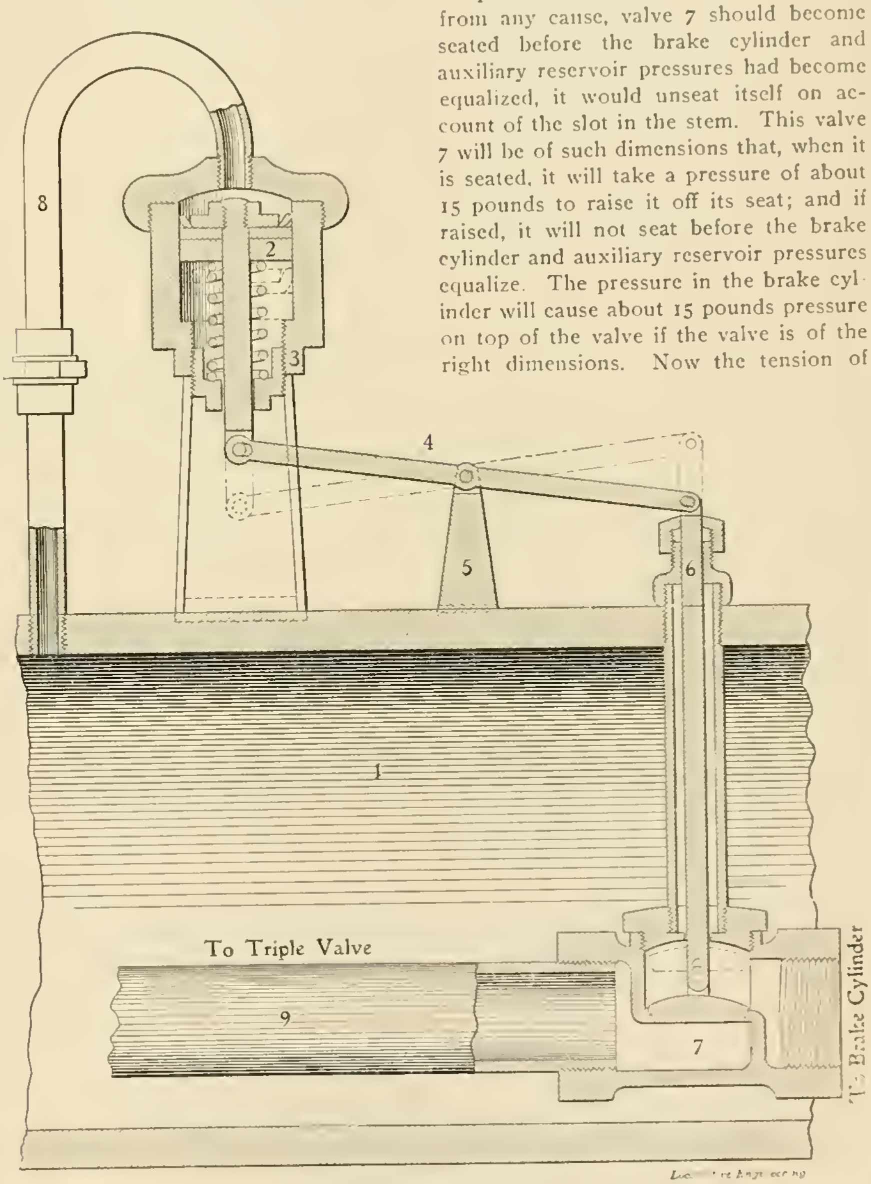
I would like to be accorded space in your journal for an airing of my automatic retaining valve which is intended to supplant the present retaining valve in general use on all air-brake cars. It works as follows:

Fig. 1 is an auxiliary reservoir, the same as the one in use at present.

Fig. 2 is a cylinder, with leather packing on the piston and a spring underneath the piston head.

Fig. 3 is an adjustable screw which gives the spring the required tension.

Fig. 4 is a lever which connects the piston rod with valve stem.



AUTOMATIC RETAINING VALVE.

Fig. 5 is a stand which is connected with the lever, Fig. 4.

Fig. 6 is a stuffing-box to make the stem air tight.

Fig. 7 is a valve and cavity in the brake pipe.

Fig. 8 is an air pipe, tapped in top of the auxiliary reservoir to convey air to top of the cylinder, Fig. 2.

Fig. 9 is a pipe running from the triple valve through the auxiliary reservoir to the brake cylinder.

With 70 pounds of air in the train line and auxiliary reservoir, the pressure will become equalized at 50 pounds. When a reduction of 25 or 30 pounds has been made in the train line in service application, set the tension of the spring with the adjustable nuts to about 52 pounds, so the tension would be about 2 pounds stronger than the pressure in the auxiliary reservoir. The equalization of the brake cylinder and auxiliary reservoir pressures would cause valve 7 to seat, thus holding all pressure in the brake cylinder. If, from any cause, valve 7 should become seated before the brake cylinder and auxiliary reservoir pressures had become equalized, it would unseat itself on account of the slot in the stem. This valve 7 will be of such dimensions that, when it is seated, it will take a pressure of about 15 pounds to raise it off its seat; and if raised, it will not seat before the brake cylinder and auxiliary reservoir pressures equalize. The pressure in the brake cylinder will cause about 15 pounds pressure on top of the valve if the valve is of the right dimensions. Now the tension of spring being set at 52 pounds, and the 15 pounds on top of valve after it is seated, would make a pressure of 67 pounds.

This device will not work when brakes are used in ordinary service application, and it would not work when brakes are applied in the emergency, as the pressure in the auxiliary reservoir would still be greater than the tension of the spring. For illustration: Suppose we had a train of 30 air cars and were drifting down a long hill and wanted to keep the train under control. We begin to apply brakes gently until the train line is drawn down to such a point that we know the auxiliary reservoir and brake cylinder pressures have become equalized; then we move the engineer's brake-valve handle back to full release, or running position, until the air gage shows 65 pounds. If the brakes are still holding good, we would move the brake handle on lap, and would have the train line and all auxiliary reservoirs charged up to within about 5 pounds of the required amount, with brakes still on and pumps at rest. Now suppose we wanted to re-apply brakes, some brakes having leaked and others still holding a sufficiently great amount of pressure to cause the wheels to slide if any more pressure is added. I have arranged for this in bottom of the valve 7, where there is another valve with another spring, the tension of which can be set at about 40 pounds, so that when the auxiliary reservoirs are being charged (with brakes on) the pressure will be uniform in all the brake cylinders.

I think this device will save the pump a great deal of work, and it will also save the necessity of brakemen going over the train and turning up retaining valves. It would be a good thing for some engineers who make from two to four applications at most every stop and then run by. If brakes were handled in this way (by this device) they would not release until enough pressure had accumulated in the auxiliary reservoirs to apply brakes as soon as they were released. As it is much better to stop too soon than not soon enough, I think this device would be a great improvement over all air brakes. It does not necessitate any changes in the present construction of air brakes, and does not require any extra hose or train line. It is to be inserted under car, on top of each auxiliary reservoir, where it cannot be seen or tampered with.

Please let me have your views on this device after you have given it your closest scrutiny.

G. M. SCHWEND.
Engineer A. G. S. R. R.
Birmingham, Ala.

[Without belittling the results of our correspondent's endeavors, we feel obliged to say, in all candor and respect, that we gravely doubt the device becoming a practical commercial success, even though it should be made to pass the usual experimental trials. The mechanical design is not of the high order of successful devices. Again, many good-appearing mechanisms on paper suffer quick collapse when given form in metals.

In the freight brake apparatus extreme difficulty would be had in placing valve 7 in the pipe running through the auxiliary reservoir, and it would be totally impossible to reach it for repairs after it was once placed there. The opportunities offered for additional leakage are against the device.

If, by any reason, the auxiliary reservoir pressure should be reduced below 50 pounds, the brakes could not be released until the pressure was restored to about 65 pounds. In service the auxiliary reservoir pressure is sometimes necessarily brought below 50 pounds and the delay then occasioned to trains would quite likely prove fatal to the device; for should a fast train be thus delayed, more than ordinary eloquence and logic would be necessary to pacify an indignant railway official. It would be difficult to offer any explanation that would satisfy him that this little irregularity was harmlessly incidental to the wrong operation of the brakes. He would probably further object to delays being made a mode of correction for the engineer who used too much air.

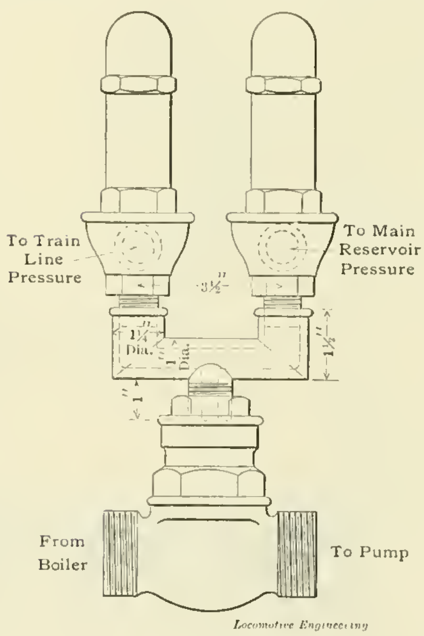
With some few modifications the device could undoubtedly be made to work satisfactorily on grades where the cars could be all kept together in that class of service; but the objections cited would beyond a doubt prove the device fatally deficient for level road work, and would prohibit its use in general service.—Eds.]

A Duplex Air Pump Governor.

Editors:

I am sending you under separate cover a blueprint of a duplex governor we have been using on our D-8 brake valves on the New York, New Haven & Hartford Railroad for nearly four years with entirely satisfactory results.

The governor consists of a standard single body and two standard tops. A special casting, made by us, unites the tops with the body. One top is connected with the main reservoir pressure and the other is connected to the train-pipe pressure.



N. Y., N. H. & H. R. R. DUPLEX AIR PUMP GOVERNOR.

When either governor is working, the blow will escape from small vent hole in the neck of the tops of them both, so it is well to put a drop of solder into one; but this is not imperative, only to save a little air. I cannot speak too highly of this invention for what it is intended to do, as I have never known it to fail when properly adjusted, and the cost is light and the benefits are great, and, best of all, the Westinghouse standards are not altered.

J. L. ANDREWS,
A. B. Insp., N. Y., N. H. & H. R. R.
New Haven, Conn.

A Queer-Acting Triple Valve.

Editors:

Several days ago we received a sleeping car from the Pullman shops, which had been in for repairs. The triple had been oiled. The brakes were tested and they worked all right. The car was placed in the train for its regular run, which was almost directly north and south, a distance of about 1,400 miles round trip.

When the train was on its return trip, the brakes began to apply in the emergency. One of the engineers who handled the train, told the last man to whom he turned it over, that every time he made two reductions the brakes would go on in the emergency; but if he made the stop with one reduction of about 8 or 10 pounds, the brakes would work all right.

When this last engineer started out, he was on the lookout for the uncalled-for action. He, however, attempted to make the stop in the usual manner. He made two reductions, and on the second reduction the brakes applied in the emergency. The next stop he tried a 7-pound application and made the stop nicely. This engineer pulled the train 162 miles, made eight stops, and a number of times the brakes were applied to steady the train on sharp curves. The superb manner in which the train was handled prevented the quick action from ensuing.

The train was composed of eight cars; six were equipped with 14-inch brake cylinders, and two with 10-inch brake cylinders.

When the train was inspected after arrival, and the brakes were to be applied, they applied in quick action on a second reduction, or a single heavy reduction of 12 or 15 pounds. When the car was received from the shops the weather was mild, and when the train returned it was much colder. The graduating pin was "O. K."

THE CAUSE.

When the car was in the shop for repairs, the man who oiled the triple valve used low-grade car oil which would freeze. While the weather was mild, the oil remained thin and did not obstruct the action of the triple; but as soon as the train came into a cold climate, the triple chilled, causing the oil to become stiff and frozen. This retarded the movement of the slide valve and prevented it from moving on a light reduction. When it did start, it went into quick action.

P. P. HALLER,
A. B. Insp., C. & O. Ry.
Covington, Ky.

An Early Locomotive Brake.

Editors:

On page 984, December number for 1896, the query is put: "Why are not more questions asked?" In what follows I have a question to ask.

The writer of this letter was for many years in the employ of the old Madison & Indianapolis Railroad. At the Madison end of this road is a grade of about 316 feet to the mile. For many years, on this grade there was a cog rack in the center of the track, and the engines used on this grade had cog wheels so arranged as to work in this rack. The locomotives were eight-wheeled, all connected in the ordinary way. About the center of the boiler, horizontal and on the top thereof, were the upright cylinders, geared to a cross-shaft underneath the boiler. On this shaft was a pinion working the main cog wheel. In each of the four cylinders was cast a passage between the steam ports that lead to each end of the cylinder. In each of these passages was a suitable plug for opening and closing the passage. These plugs were attached to suitable levers, placed handy for the engineer to operate.

Now, in dropping down this grade, the locomotive was hitched onto the down-hill end of the train and was run backward. The upright cylinders were geared for forward motion only, and there was no reverse lever. This, of course, converted all of the cylinders into air pumps when the engine dropped backward down the hill. Each stroke of the piston filled the cylinders with air, and thus made a very efficient braking apparatus.

The writer of this letter ran these engines many times, and they were used as described for over twenty years, but are not used now. The question I want to ask is: Was not this a better plan than the water brake as described on page 982 by Mr. Hedendahl, and would it not be better still, where air brakes are used, especially on freight trains, to run a pipe from one of the steam chests, having suitable valve thereon, to the main air reservoir, to be used in cases of emergency to supply air? If not, why not?

BENJ. W. SMITH.
Princeton, Ind.

[The scheme is a good one: It is used, and has been used for some time.

In addition to the air brake and the water brake, there has been used for some years past on the locomotives of some of the Western railroads a brake known as "The Sweeney," so called after the inventor, Thomas Sweeney, a locomotive engineer on the Southern Pacific system.

The Sweeney brake is used on the locomotive only, and is designed to convert the steam cylinders of the locomotive into air pumps when the reverse lever is placed back of the centre notch. To do this, the steam chest is tapped by a 3-inch pipe which leads to the main reservoir. In this pipe is a globe valve which can be opened or closed by the engineer in the cab. There is also a safety valve in the pipe between the globe valve and the main reservoir which relieves the pressure in case it is sent too fast or too high to the main reservoir; also, a non-return check valve.

To operate the Sweeney brake, the engineer reverses his engine, opens the globe valve, and thereby makes air pumps of his steam cylinders which compress air through the pipe into the main reservoir for use of the train brakes. The pumping action of the pistons in the steam cylinders also retards in a measure the speed of the train. The Sweeney brake is thrown out of action by closing the globe valve and placing the reverse lever ahead of the center.

The water brake, as described by Mr. Hedendahl in a recent number, is a useful auxiliary brake for heavy mountain grades, and is quite different from the Sweeney brake. The former brake imparts retardation to the train by the resistance of the air pressure against the pistons in the steam cylinders when the engine is reversed. The Sweeney brake converts the pistons and steam cylinders into air compressors when the engine is reversed, and pumps air for the use of the train brakes. The water admitted to the steam cylinders during the operation of the water brake serves merely as a cooler, and when any more is admitted than will vaporize, it will be thrown out at the stack and cylinder cocks. Water is not the retarding force in the water brake, as many persons unthinkingly believe.—Eds.]

A Dutchman's "Rapid Fire" Brake.

To der edditur uf dot Air Brage debardment on Logomodif Ensheneering:

Lasd weeg I in Musgogee was in der Intyant derridory to visid my son who a skqaw has marrit oafer dere.

I was sdanting on der bladform py der sdashun ven one uf dem fasd gow dranes goes by on der gaty unt ven der ensheneer he abblies der air brage dot mages some noiss lige ef he got hiss sylinter goks opent, or dot he school off er rabid vire kun. I dond unterstant me dot. I gott me fife poinds in der insdrugshun gar unt I neffer hert dem brageses mage such kint of noiss pebore dey goss on, dey mage dose noises ven dey goss off.

I asgk der draffelingk ensheneer fy dot vos undt he dolt me dot was de ladest improft brage only der ensheneer forgod him to closs hiss sylinter goks on der brage sylinters. I sait, "Oh dots itt is itt," unt he sait "Yaas," but ven I went to der utter ent of dot bladform der draffelink ensheneer unt anotter longk lekket feller dey laff lige der diffel.

Vot I wants me now to find me oudt is who der laff iss on. If dose air brages now haf sylinter goks den I wants to fint me dot oudt, unt go mit myself a gorce dru in der instrugshun gar.

Yourss druly,
FRITZ PUMPERNICKLE.
Keokuk, Ia.

[The traveling engineer and the tall young gentleman were making fun of you. Air brake cylinders don't have cylinder cocks for the engineer to forget to close. You had better take another course in the instruction car, and get more points.

The mysterious occurence you describe was merely an emergency application of an odd style of brake which vents the train line pressure to the atmosphere, instead of to the brake cylinder, as with the standard form of triple valve. Each car in this system vents to the atmosphere in quick succession, and produces the noise you describe as resembling the firing of a rapid fire gun.—Eds.]

Frozen Packing Leathers.

Editors:

During the winter season, when the weather is very cold, we have engineers come in and report that the tender brake will not work. Examination shows that the packing leather has frozen to the cylinder. If the engine remains in the house for a short time, or a little fire is held under the cylinder, the brake will work "O. K."

This trouble is experienced with engines that are known to have main reservoirs drained regularly, and all other conditions being good; and also, with tenders that do not have the water scoop.

We do not have so much trouble with packing leathers freezing to brake cylinders under cars. The question has come up among ourselves, that perhaps other people do not have this kind of trouble. I would be very glad to hear, through "Locomotive Engineering," of a sure cure for this complaint.

J. R. ALEXANDER,
Gen. A. B. Insp., P. R. R.
Altoona, Pa.

[In order that the leather packing may freeze to the walls of the cylinder, there must necessarily be moisture present. Examination of the parts and the thawing-out process which corrected the trouble prove that moisture was present.

The data given by our correspondent indicates that the moisture was not placed in the cylinder by the splashing of the water scoop in taking water from the track tank, and that it did not find its way there from the main reservoir and train pipe. If the latter route were used, the triple valve would freeze and give trouble before the freezing of the packing in the cylinder would become manifest.

As no reference is made to the triple valve, it is presumed that it performed its functions undisturbed.

The moisture which is necessarily present to permit of freezing must, therefore, effect its entrance to the cylinder either when the leather packing is renewed, or with the oil which is injected through the oil hole.

The leather packings furnished by the air-brake manufacturer undergo a treatment by which the pores are filled with a grease that preserves the leather. These packings seem hard and stiff at first, but may be made soft and pliable by subjecting them to the heat of the sun or a stove, and working them with the hands. When placed in this condition, their entrance to the cylinder is easy. Some repairmen are unacquainted with this process, and soak the leathers in water to render them pliable. Soaking is necessary with unprepared leathers, but a heavy-bodied oil or grease should be used. Leathers soaked in water, to shape and prepare them for easy entrance to the cylinder, will freeze in cold weather. The fact that freezing of leathers is not experienced in the same degree on tenders and cars indicates that the treatment is not the same, or that the oil used is of a different kind in our correspondent's roundhouse and car shops.

Light-bodied oils which offer little resistance to freezing are used for oiling brake cylinders on many railroads. In some shops any oil, regardless of its quality, is considered good enough for brake cylinders. Recent experiments made by the Air Brake Association prove that a good grease is superior and more economical for this purpose than oil. In tests on several of the Northwestern railroads, where below zero weather prevails the greater part of the winter months, Kent's Compound, as a brake cylinder lubricant, gave extremely satisfactory results, and has since been adopted by the Westinghouse Air Brake Company.

We would recommend a trial of this grease, as it is peculiarly adapted for such use as desired by our correspondent, and gives equally satisfactory service in driver-brake cylinders which suffer from the firebox heat.—Eds.]

Proper Procedure in "Double Heading."

Editors:

A singular case occurred on a road in this Western country, a short time ago, that would perhaps bear repeating.

Over a certain section of the road, a "helper" is employed for all full-tonnage freight trains. This "helper" is a powerful engine. Many of the small road engines have light frames, and it is therefore made a rule to place the road engine ahead in double-heading.

On the particular trip in question, the air pump of the road engine had broken a valve and was doing poor work. So Mr. Road Engineer requested Mr. Helper to do the pumping and braking. The train then ascended and descended three heavy grades, and then approached a level where they had a meeting-point with a train of superior rights, which rights they tried to knock out by damaging the three engines to a slight extent.

Upon investigation, each engineer claimed he was waiting for the other to make the station stop at their meeting-point, as neither of them had applied the brake coming down any of the heavy grades. The trainmen claimed that they were on top all the way; never saw the air handled any more nicely on the hills; and furthermore, that the *train had no leaks*. Here is a case where truth (?) is indeed stranger than fiction.

I bring this tale up to arrive at the proper procedure in a case of this kind.

Where, for any reason, the defective pump has to go ahead, it might do for the head man to do the braking, even though the second man did the pumping. If the head engineer carries his brake-valve handle in full release position, his main drum can be charged up with the train line, provided the second man uses running position in recharging. When the head man applied the brake, if the second engineer cut out or lapped his valve, the braking would be done all right. There would be enough main drum pressure on the first engine with which to release an average train, which release would be a signal to Engineer No. 2 to place his handle in running position for recharging.

As this is by no means an imaginary case, although exceptional, I would be glad to hear others' views on the subject.

E. W. PRATT,
Genl. A. B. Insp., C. & N. W. Ry.
Chicago, Ill.

[If the engineers did not use the air brakes in descending the "three heavy grades" and the trainmen set no hand brakes, and it is true that "the train had no leaks," the occurrence as described must contain considerable "fiction"; for an unbraked train will drop down a heavy grade of any considerable length at a speed which will not mislead all hands concerned into thinking that someone else is doing the braking.

If the air-brake apparatus on the head engine should become so disabled as to make the operation of the train brakes necessary from the second engine, it would seem that satisfactory arrangements for so doing could easily and understandingly be made by the two engineers.

On roads where double-heading is done, the practice of the leading engineer doing the braking is pretty generally established. This practice is deviated from in cases of the "helper" being coupled on for a short run up grade where there is little or no braking to do, and in cases where the air-brake apparatus on the leading engine becomes disabled. Should an accident occur to either the pump or the brake valve on the leading engine, it is considered better practice to turn over the pumping of air and operation of the brakes to the second engineer, instead of having one man do the pumping and the other the operating.

While it is possible to do the pumping on one engine and the operating from the other, it is generally believed that the successful operation of the process depends too much upon certain refinements of operation to make it of any considerable practical value. This co-partnership scheme, however, has been successfully operated, and certain exigencies may make its employment advantageous in cases where both engineers understand its operation and understand each other; but aside from the novelty of the operation, and the satisfaction had in being able to use it to squeeze out of a tight place, its greatest recommendation is that it is a part of the knowledge of the man who knows how to take advantage and make the best use of brakes under adverse circumstances. Material objections seem to outweigh the advantages of the scheme when it is compared to the surer and safer way of cutting one man out, and giving full control and responsibility of the brakes to the other man.—Eds.]

December Air-Brake Patents.

We compile from the "United States Patent Office Gazette" the following list of patents on air brakes and directly related devices that were granted during the month of December, 1896. The patents and names of patentees are as follows:

No. 572192. Niels A Christensen, Milwaukee, Wis. Air Pump Valve.

No. 572518. William S. G. Baker, Baltimore, Md. Car Brake.

No. 572553. William Mable, Fort Collins, Col. Air Brake.

No. 572569. Carl J. Rosen, Jr., Topeka, Kan. Brake Beam.

No. 572662. William Robinson, Boston, Mass. Power Brake.

No. 572802. Solon G. Howe, Detroit, Mich. Car Brake.

No. 572871. Alex. Dallas and Oscar P. Amick, Herington, Kan. Fluid Pressure Brake.

No. 572939. Chas. B. Fairchild, New York. Vehicle Brake.

No. 572992. Moses G. Hubbard, Jr., Chicago, Ill. Brake Connection for Trucks.

No. 573024. Thomas Miller, New York. Car Brake.

No. 573190. Geo. Westinghouse, Jr.,

Pittsburg, Pa. Fluid Pressure Automatic Brake.

No. 573227. Alva A. Lindley, Oskaloosa, Ia. Brake Shoe.

No. 573246. Vardiman T. Sweeney, Springfield, Ky. Vehicle Brake.

No. 573252. Wm. W. Whitcomb, Wakefield, Mass. Brake Shoe.

No. 573376. John L. Wicks, Fitzgerell, Ill. Brake Shoe.

No. 573523. John McLachlan, Chicago, Ill. Brake Shoe.

No. 573613. Dominic C. O'Kain, Wilkinsburg, Pa. Slack Adjuster for Brake Rigging.

No. 573663. Benj. F. Jackson, Sutton, W. Va. Car Brake.

No. 573790. Harvey S. Park, Chicago, Ill. Fluid Pressure Brake.

No. 573791. Wm. Pendley, Hinton, Ga. Automatic Brake.

No. 574062. Wm. H. Hall, Baltimore, Md. Automatic Air Brake.

No. 574067. Edward J. Knapp, Syracuse, N. Y. Hose Coupling.

No. 574236. Jos. S. Blackburn, Salem, O. Hose Coupling.

No. 574268. John M. Rainey, Kellerton, Ia. Automatic Car and Air Brake Coupling.

Air Brake Items.

Several patent brake shoes having metal bodies in which cork blocks or sections are inlaid, have recently been granted. The cork is forced in under compression, and is retained in the cavities by the natural expansion. High frictional qualities are reported from light service tests of these shoes.

The following original description of the function of the graduating valve is given by a bright fireman. He says: "Controlled by train-pipe pressure, the graduating valve acts as a governor for the auxiliary reservoir pressure going to the brake cylinder until equalization takes place all around, and then it retires."

The Forty-fourth annual report of the Railroad Commission of Connecticut, under date of December 19, 1896, says: "The commissioners call attention to the need of power brakes on electric cars, especially where two or more cars are run together. An efficient brake is believed to be a greater preventative of injury to persons on the track than any kind of fender."

The Hardie compressed air locomotive, for trial on the New York Elevated railways, has been completed at the works of the New York Locomotive Company, Rome, N. Y. According to report, it has no smokestack, and a two-wheel instead of a four-wheel truck. The four driving wheels are under the reservoir, which takes the place of the boiler, and the cylinders are under the cab. A compressor plant is being established at Greenwich street.

A new form of slack adjuster for brake rigging has been patented by Dominic C. O'Kain, Wilkinsburg, Pa. It is a combination of a live and dead lever and a rod pivotally connected to one of the levers and provided with teeth on its upper and lower sides, the teeth of one side having a length slightly greater than the normal distance of the brake shoes from the wheels; and two rods provided with teeth corresponding in length and adapted to engage the teeth on the other rod and so pivoted to the other lever as to have different ranges of movement when shifted by the lever. The arrangement looks as if it would work, but there are too many parts to it.

Fourth Annual Convention of the Air Brake Men.

Secretary Kilroy has issued to the members of the Air Brake Association a circular letter from which we make extracts as follows:

"Due and regular notice is hereby given that Mr. S. D. Hutchins has resigned the office of president, and Mr. M. E. McKee, first vice-president, succeeds in regular order to that office. Mr. Hutchins, having ceased to be an active member, on account of having severed his connection with a railway company, becomes disqualified for holding office as per sections 1, 2 and 3, Article III of the constitution.

"By request of Mr. Otto Best, President McKee has ordered that C. C. Farmer assume the chairmanship of the Committee on 'Air Pumps, Their Troubles and Treatment, and Tools for Making Repairs,' and that Mr. Best take the place vacated by Mr. Farmer on the Committee on 'Foundation Brakes for Locomotive Tenders.' Regular notice is hereby given both committees, and they will be governed accordingly.

"The Committee of Arrangements for the fourth annual convention to be convened at Nashville, Tenn., April 13, 1897, reports that the Nicholson House has been selected for headquarters, where the following special rates will be given the members and their friends. Rooms for single persons, including meals, $2, $2.50 and $3 per day. The $3 rooms have baths. Two persons together will be given large front rooms, with meals, at $2 per day.

"The meeting will be called to order by the president at 9 A. M., April 13th, in the State Capitol, which is a few blocks distant from the hotel.

"Members desiring to attend the convention should make application for transportation to their immediate officials, in regular order, in ample time to permit the same to be obtained."

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(15) W. H. R., Cleveland, O., asks:

Are the Westinghouse air pumps and attachments ever leased to railroad companies, or are they sold direct? A.—The Westinghouse fixtures are sold outright to railroad companies.

(16) B. L. S., Midland, Ontario, asks:

When air is cut, all hose put in dummy at a terminal station, why will brakes set on a certain coach? When bled, will go on again until air is out of auxiliary. Car repairers say triple is all right. A.—There must be a leak in the train-line pressure on this coach, or in a part of the triple valve where train line pressure is. Probably a stopped-up leakage groove combines with the leak to give this trouble.

(17) C. R. O., Toronto, Can., asks:

Would you please say why 70 pounds pressure per square inch became the standard train-pipe pressure, and how the auxiliary reservoir received its present proportioning to the brake cylinder, or, in other words, why an equalized pressure of 50 pounds per square inch was chosen? A.—These pressures were found by experiment, and as they were believed most advantageous and economical, their adoption followed.

(18) J. W. M., So. Frankfort, Mich., asks:

Please inform me which brake will release first after an emergency application, the one with the long or the one with the short travel. A.—The long travel piston will start to release first with a slow increase of pressure in the train pipe, but when the short piston travel starts it will finish quicker. With a sufficiently high excess pressure thrown into the train pipe to increase the train-line pressure above the auxiliary pressure of both cars, both brakes will start to release about together, but the short travel will finish first.

(19) G. K. S., New London, Conn., asks:

1. Are the receiving and discharge valves the same size in an 8-inch pump; also are they the same in a 9½-inch pump? A.—The air valves of the 8-inch pump are not of the same diameter, but when the receiving valve is given a ⅛ inch lift and the discharge valve is given a $\frac{5}{32}$ inch lift, they both give the same amount of opening. The construction of the 9½-inch pump permits a larger valve to be used, and both receiving and discharge valves are given $\frac{5}{32}$ inch lift. 2. Is the 9½-inch the largest pump made by Westinghouse? A.—Yes.

(20) J. S., Quincy, Ill., asks:

1. What is the trouble with engineer's equalizing discharge valve when you draw off 10 or 12 pounds and shove the handle back to lap the brakes let go? A.—The rotary valve probably leaks and permits the main reservoir pressure to pass back into the train pipe and release the brakes.

2. What would you say if you had a brake-valve reservoir half of an auxiliary 12 x 33; what will be the result? A.—There would be no bad result. The dropping of the black hand and the reduction of pressure at the preliminary exhaust port would be slower, but ordinarily would not be harmful.

(21) W. L. B., Rutland, Vt., writes:

I have an 8-inch air pump which pounds badly; air valves have proper lift, and pipes and passages are clean. Pump does not sound bad from the ground, but it makes things jump in the cab. Pump has run ten months. What is wrong with it? A.—Your pump is probably fastened to an insecure and shaky frame. There are three principal kinds of pound in a pump: A pound resulting from the piston head striking the cylinder head; this is common at low pressure. Another pound comes from a sort of dull "thump" when high pressures are reached. The jarring pound frequently made by a pump, and felt in locomotive cab, is caused by the pump being insecurely fastened to the boiler.

(22) J. A. J., Nashville, Tenn., writes:

You quote me wrong in my question in January number of "Locomotive Engineering," relative to pressure obtained working quick action where extra *thick* pipe is used, you say extra *large* pipe. On our passenger equipment our train pipes are 1 inch extra thick pipe, making the internal area considerably less than the common gas pipe ordinarily used. Please make correction. A.—If, in increasing the thickness of the pipe, the inside diameter has been lessened, the amount of train-pipe air passed to the cylinder will be proportionately less. If the increased thickness is made up on the outer surface, and the inner diameter of the pipe remains the same, there will be no difference, of course, in the volume of train-pipe air going to the brake cylinder.

(23) C. R. O., Toronto, Can., asks:

How were the relative sizes of the preliminary exhaust port and equalizing reservoir secured? I understand the object in proportioning these parts is to prevent quick action on a one-car train. Theoretically I suppose it would be, viz., as the auxiliary reservoir is to the graduating port, so should the equalizing reservoir be to the preliminary exhaust port—the graduating spring overcoming the difference in pressure required to start the triple. A.—The sizes of the respective preliminary exhaust ports in the Plate D-8 and Plate E-6 brake valves were determined experimentally and with no particular reference to the sizes of other ports in triple valves or the volume of air in auxiliary reservoirs. The object sought in experimentally determining the size of the preliminary exhaust port and equalizing reservoir was to merely obtain a gradual instead of a sudden preliminary rise of the equalizing piston of the brake valve, so as to start the exhaust of air from the train line through the fitting at the foot of the brake valve gradually instead of suddenly; a sudden discharge being likely to cause quick action on a one-car train.

(24) J. A. J., Nashville, Tenn., writes:

In answer to question No. 187, December number, it is claimed that no particular effort is made to make an air tight joint between the bushing and the shoulder or beveled part on the piston. I have always considered that there should be a true joint or seat at this point, and that the flow of air from train line to auxiliary was regulated by the feed groove in this beveled part; if this is not done, a worn piston packing ring, or one that leaked, would charge the auxiliary much quicker than one with a good fitting packing ring. Why is this shoulder and bushing beveled if it is not to form a true seat? A.—Both feed grooves in the triple act as a check, one upon the other, both being as nearly as possible of the same size and capacity. It is believed this is the best plan, all things considered, since, if the groove on the beveled surface of the bushing were to govern the feed, the deposit of a small obstruction to the triple-valve piston seating against this surface would interfere more or less seriously with the functions of the feed port. A triple-valve packing ring must wear to an abnormal degree to seriously increase the feed, and would require a good many years' service to bring it about.

(25) D. M. W., Southbridge, Mass., writes:

Does the slide valve in plain and quick-action triple valves move more than once in one service application of the brake, making two or more reductions? A says that after the first reduction of 8 or 10 pounds, it is the triple piston and graduating valve that moves, and not the slide valve. B says the slide valve moves and compresses graduating spring after the first reduction, and brings port *S* in valve opposite port *R* in seat. Who is right? A.—The first service movement of the triple piston is to draw the graduating valve from its seat inside of the slide valve, thereby opening the inlet end of the graduating port. The piston, continuing its traverse, draws the slide valve to the position where the outlet end of the graduating port registers with the brake cylinder port, thus making a communication from the auxiliary reservoir to the brake cylinder, through which pressure from the former place will flow to the latter until the auxiliary reservoir pressure is thereby reduced a trifle lower than the train-line pressure. Then the piston and graduating valve will move toward release position until the graduating valve seats and closes the communication between the auxiliary reservoir and brake cylinder. In succeeding reductions, until full service application is had, the slide valve does not move again. A is therefore right.

"Our Express Trains" is the title of a publication issued by Stackhouse & Co., publishers, London, England. The book is very profusely illustrated and gives highly colored pictures of most of the leading express trains in Great Britain. It is sold by the publishers for sixpence.

A very convenient and durable form of stair tread is being made by A. J. Beckley & Co., Meriden, Conn. It is light, clean and very durable, and collects no objectionable dirt apt to become a menace to health. These treads are recommended highly for railway car purposes, and seem to be entirely suitable for the purpose.

The American Industrial Publishing Co. of Bridgeport, Conn., have issued a new list of books, which they will send free to anyone who makes application. The company deals in scientific books relating to steam, mechanics, engineering, etc.

India has a fairly good system of railways that are managed by the government and by a few private companies. There has lately been a demand for an acceleration of railway mail service throughout India and the railway people are preparing to make the required change. Up to the present time the maximum speed in India has rarely been more than 25 miles per hour.

We have noticed lately a revival of interest in the advantages to be derived from putting speed retarders in the fire tubes of boilers. All that we have ever seen or heard about the effect of tube retarders is that they increase to a greater or smaller degree the amount of heating surface. A much simpler way than putting in retarders inside tubes would be to put in smaller tubes, which would produce the same effect with less annoyance from the choking-up of the inside of the tubes.

The Bell spark arrester, designed by Mr. J. Snowden Bell, which we illustrated some years ago, has been applied to some heavy locomotives built for the Baltimore & Ohio by the Pittsburg Locomotive Works. The peculiarity of the Bell spark arrester is a double perforated deflecting plate, and the arrangement of the netting in a series of planes that have a triangular section, the idea being to increase the netting area, at the same time having no horizontal surface. The practical result of using the Bell spark arrester, we understand, is that it not only lessens spark throwing, but materially increases the life of the netting.

Here is the way a respectable English engineer begins a letter, replying to a correspondent of "Engineering," whose views he did not agree with: "I have seen a French history of the steam engine, in which the names of Watt, Stephenson and Fulton did not appear. A French writer, in writing of chemistry, said: 'Chemistry is a French science.' Some years ago it was a common saying in England that all foreigners were Frenchmen, and all Frenchmen were fools. Many years ago an Englishman, in writing of France, said: 'France is a country where the people eat frogs and speak a vile lingo that nobody can understand.' I once knew of a young Englishman who, having graduated from a technical college, obtained a situation to go to the States, but, before doing so, he provided himself with some firebricks, some common bricks and a quantity of stovepipe, and it was said that he was much astonished upon arriving in the States to find that the Americans were actually making bricks and that stovepipe was not unknown."

The British engineering papers have been giving somewhat glowing descriptions of a new complete Pullman train, which began last month to run on the Southeastern Railway between London and Hastings. A peculiarity about it, for a Pullman train, is that it consists of first, second and third class vestibule cars. The first-class passenger is provided with an upholstered revolving chair, all to himself, which is a novelty to British travelers. These cars are finished with green and gold trimmings, decorated alcove panels, and a great deal of varied embellishments to increase the luxurious appearance to the highest degree. The second and third class cars have less pretentious furnishings, but are said to be very comfortable. The train is lighted by electricity and heated by hot-water circulating system. Our English friends say that the trains mark a new epoch in English traveling.

Reports to the engineer maintenance of way by the supervisor of signals, on a leading trunk line, show most satisfactory results obtained with a waterproof graphite grease manufactured by the Joseph Dixon Crucible Company, Jersey City, N. J. At one point, from October 1st to November 28th, ¼ pound of the waterproof Dixon's pure flake graphite grease was used on locks, cranks and compensations on outside and on machine in tower. The cost of putting on was found to be very little more than oil. The same test was made at another point on the road with the same good result. The supervisor found the waterproof graphite grease better than any other kind of lubricant, as it can be applied quickly and stays where it is put. It is also clean and the water has no effect upon it. Therefore the supervisor strongly recommends the use of this grease for all the places named above.

The next conventions of the Master Car Builders' and Master Mechanics' Associations will be held at Old Point Comfort, Va., commencing Tuesday, June 8th. The headquarters will be at the Hotel Chamberlin, where satisfactory rates have been secured. Parties wishing for rooms should apply to Mr. George W. Swett, manager of the hotel, for accommodation. The Hygeia Hotel, where two or three previous conventions were held, will also be open. Mr. F. N. Pike, the old genial manager, will be glad to do his best for his old friends. Messrs. S. A. Crone, of the New York Central, and R. H. Soule, of the Norfolk & Western, constitute a joint Committee of Arrangements.

Parties who have suffered loss by fires caused by sparks from locomotives, cannot recover unless it is shown that the railway company was guilty of negligence in not using a good form of spark arrester on the locomotive. Decisions on these lines have been so uniform of late years that suits for damages of this character are becoming very rare. It used to be the case that any house or factory near a railroad, getting on fire, the railroad company was blamed and sued for damages. Railroad companies have been compelled to pay thousands of dollars in this way when spark-throwing had nothing to do with the origin of the fire.

As a matter of curiosity, United States Consul Morris at Ghent reports to the State Department that the most expensive product in the world is the charcoal thread employed for incandescent lamps. It is for the most part manufactured at Paris and comes from the hands of an artist who desires his name to remain unknown in order to better protect the secret of manufacture. It is by the gramme that the product is sold at wholesale. In reducing its price to the basis of pounds, it is easily found that the filaments for lamps of twenty candles are worth $8,000 per pound, and that for lamps of thirty candles they are worth $12,000 per pound. The former have a diameter of twenty-thousandths of one millimeter, and the latter four and one-half thousandths of a millimeter. The filaments for lamps of three candles are so light that it would require nearly 1,500,000 of them to weigh a pound. As the length of each of them is ten centimeters, their total length would be 187 miles.

The Baltimore & Ohio Railroad Company estimate that the travel to witness the inauguration of the President next month will be twice what it was four years ago.

The Ashcroft Manufacturing Company, 111 Liberty street, New York, have issued a new illustrated catalog, showing the various devices manufactured by the company. Besides illustration of their products, there are very good half-tones, showing the works and inside views of the various shops. This catalog is particularly interesting to shopmen, owing to the great variety of shop appliances which are shown in it. Besides a great variety of shop tools, gages, etc., the catalog contains very handsome illustrations of the Tabor indicator, and a most interesting article on the use of the injector. The catalog will be sent, on application, to parties interested in the Ashcroft Manufacturing Company's products.

The Norton Emery Wheel Company, Worcester, Mass., have issued what they call an "Illustrated Catalog of Emery Goods and Grinding Machinery." It is very handsomely got out, and we think the proper name of it ought to be a "Hand-book of Emery Goods and Grinding Machinery," for besides illustrating the various appliances made, it gives a great deal of technical information regarding them, which we are not aware has ever been published before. They intimate that they are willing to send the catalog to anyone who applies for it. Our railroad friends who are interested in emery wheel work will find this catalog very valuable, and we should advise them to send for it.

Some improvements in the Smith exhaust pipe have lately been patented by the original inventor of the pipe, John Y. Smith, of Doylestown, Pa. The new features patented consist principally of a peculiar form of diaphragm plate, which will be applied between the flues of the exhaust pipe. The Smith exhaust pipe is becoming very popular, and is highly spoken of by the roads using it. A striking peculiarity about it is that anyone listening to the exhaust of a locomotive, having the exhaust pipe on, can tell it by the soft sound of the exhaust. This, of course, means lower velocity of gases through the flues, and ought to result in saving of fuel.

Several important changes have lately been made in the staff of the Westinghouse Electric & Manufacturing Company. Mr. L. Bannister, previously general manager, has been made first vice-president, with control of the whole commercial business of the company. His office will be in New York City. Mr. R. H. Warren, who was assistant to Mr. Bannister, has been made second vice-president, and he will have charge of the manufacturing department and will look after the large plant at East Pittsburgh. Mr. P. F. Kobbe has been made third vice-president, with charge of the financial department of the company, with office in New York City.

Two very handsome illustrated handbooks have been recently issued by that most enterprising of general passenger agents, Mr. George H. Daniels, of the New York Central Railroad. One tells all about the trip of Prince Michel Hilkoff, Imperial Minister of Ways and Communication of Russia, over the New York Central. The other tells about New York as a winter resort. They are both profusely illustrated with very fine half-tones, and are got up in first-class style. That relating to New York as a winter resort will be found a convenient guide to America's greatest city.

The Hancock Inspirator Company, of Boston, make an announcement that they will conduct the sale of their goods direct in future. For several years past the Fairbanks Company have been exclusive selling agents for the Hancock inspirator for stationary boilers, and also of the Hancock ejectors. Mr. Wm. McGowan, Jr., so well known to railroad men, who is now treasurer of the Hancock Inspirator Company, is vigorously pushing the injector in all directions.

We have received from the Cincinnati Milling Machine Company catalog just issued, which describes an entirely new line of milling machines, possessing many important improvements incident to modern milling practice. The company will send their catalog on application to parties interested in this kind of work.

One of the greatest travelers of the world is Capt. W. W. Peabody, vice-president and general manager of the Baltimore & Ohio Southwestern. He appears to practically live in his private car, for last year he traveled 54,419 miles, and that was not by any means the greatest travel made by him in one year.

The New York Belting & Packing Company have opened a large warehouse at 143 to 145 Lake street, Chicago, Ill., where they will carry a complete stock of rubber goods and mill supplies. It is the intention to make this the distributing point for the company's business.

A correspondent in Richmond sends us an account of a fast run made on the Chesapeake & Ohio, where a six-coupled engine with 4-foot drivers maintained a speed of 45 miles an hour, and at one place ran 8 miles in 9 minutes.

A judgment has been obtained by the Morris Box Lid Company, of Pittsburgh, against the Davis Pressed Steel Company, for infringements of patents.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(6) W. H. R., Cleveland, O., writes:

Kindly tell me if it is customary for shop men who run lathes and planers, or other tools, to keep those tools clean? A.—In most shops it is an unwritten law that a man running a machine shall have sufficient pride to keep the tool fairly clean. It is the rule in many places for the men operating tools, to stop work on Saturday afternoons one hour before quitting time, and devote that hour to a general clean up of the tool and its surroundings.

(7) J. S., Quincy, Ill., asks:

What size stack would you suggest for a 17 x 24 engine, measuring the same at the top as at the bottom? A.—Considerable latitude is allowed in the proportions of a locomotive stack, and there is therefore a great diversity of opinion among mechanics as to the proper ratio of diameter between cylinder and stack. Our experience with 17 x 24 engines has shown that a stack can be used from 13 to 16 inches in diameter and give practically the same results. We would recommend a stack not less than 14 nor more than 16 inches in diameter, for a 17-inch cylinder.

(8) J. L., Albany, N. Y., writes:

Please answer through your publication the following question: Is it possible for one looking at an engine just out of the shop, to tell upon which side of that engine a thump or pound will first be developed in the boxes or wedges, considering the wear to be equal on both sides? I contend that what is known as a right-hand lead engine will first show pound on the left side, and a left-hand lead engine will first show a pound on the right side. Am I correct? A.—Our experience in locomotive practice has never shown anything to confirm your statement. If there are any well-authenticated cases of pound in accordance with the conditions you propose, we would be glad to have the facts.

(9) C. H. S., Ottumwa, Iowa, writes:

1. Can you tell me through your columns, whether a person can take a boiler and put a pressure of 150 or 180 pounds of steam on it without any water in the boiler, and start an injector throwing water into the same boiler with the water below the check line? We have had an argument on this point, and leave it to you for settlement A.—Injector manufacturers to whom this question was referred, say that an injector will work under the above conditions. 2. Has not the Central Railroad of New Jersey got a single driver compound pulling passenger trains? There are runners here who say she is not a success on account of slipping, is that a fact? A.—We understand that this engine will do all that was claimed for her by her designers.

(10) G. D. B., Oakland, Cal., writes:

Please furnish a rule to ascertain the length of a corner brace for a box car. The space between all posts is four feet. The height between the sills and plates is 6 feet 11 inches. Camber in the car is 1 inch. A.—The length of braces may be computed from the formula for finding the length of a side of a right-angled triangle, when the other two sides are known. Letting h equal the height, 6 feet 11 inches, and b equal the base, 4 feet, the distance between the posts, we have for the length of the brace, $\sqrt{6.916^2 + 4^2} =$ 7.989 feet, or 7 feet 11⅞ inches, nearly. Written, this would be expressed: The square of the height in feet is to be added to the square of the base in feet, and from the sum the square root is to be taken. The safest and most expeditious method of handling this problem in practice, is to mark off the braces from their respective positions, or cut them to templates known to be correct.

(11) F. H., Whitecliff, New Zealand, asks:

1. What is best to be done with the strips of a balanced valve when they are blowing very hard? A.—True up the strips and the balance plate against which they wear. 2. If running an engine with slide bars above and below the crosshead, and the top shoe breaks, how would you fix her up to run in? A.—Since the greatest pressure is against the top guide and shoe while the engine is running forward under steam, you can take the bottom shoe and place it at the top, and run in slow. 3. What would you do if the piston seized while the crank pin was on the top quarter, with an engine that you could not get at the keys in that position, nor get the pin out of the crosshead in order to uncouple? A.—The situation is an impossible one. There was never yet a locomotive so constructed that either one or the other ends of the main rod could not be disconnected, no matter what its position.

(12) W. G. Wallace, Baraboo, Wis., asks:

Would you kindly explain the friction of fluids, and give the correct answer to the question, "What is the friction of fluids?" A.—Fluid friction is the resistance to motion due to roughness of a vessel or pipe containing the liquid; a proof of this can be had by comparing the velocity of liquid flowing through long and short pipes, and also through rough and smooth pipes. The short and smooth pipe will be found to give a higher velocity, showing a decreased resistance. Trautwine says, in referring to this subject, that "the friction of liquids, moving in contact with solid bodies, is independent of the pressure, because the lifting of the particles of the fluid over the projections on the surface of the solid body is aided by the pressure of the surrounding particles of the liquid, which tend to occupy the places of those lifted. Hence, we have, for liquids, no coefficient of friction corresponding with that (= resistance ÷ pressure) of solids. The resistance is believed to be directly as the area of surface of contact. Recent researches indicate that resistance = a coefficient × area of surface × velocity to the *n*th power, in which both *n* and the coefficient depend upon the velocity and upon the character of the surface; and that at low velocities $n = 1$, but at a certain "critical" velocity (which varies with the circumstances) *n* suddenly becomes = 2, owing to the breaking-up of the stream into marked counter currents or eddies. The resistance of fluid friction arises principally from the counter currents thus set in motion, and which must be brought into compliance with the direction of the force which is urging the stream forward."

(13) F. S. B., Easton, Pa., writes:

In the October number of "Locomotive Engineering," in the article "American Railway Master Mechanics' Committees for 1897," the following is to be answered by the committee: "What should be the ratio between diameter of cylinder and length of steam port?" Would you please inform me what points are considered in the determination of this ratio? 1. A.—The principal important thing governing the design of steam ports is to have them of such dimensions as will give a free exhaust with the least back pressure on the pistons, and at the same time allow steam to enter the cylinder at as near boiler pressure as possible. If the first condition is fulfilled, the second is most usually found to be provided for. Mr. D. K. Clark's "Railway Machinery," an authority widely quoted, says that a steam port having an area equal to one-tenth that of the cylinder, will, at a piston speed of 600 feet per minute, give a free exhaust. Taking this as a basis for any other speed, the port will, of course, be proportionally larger or smaller, as the speed is to be greater or less. For a piston speed of 500 feet per minute, and a cylinder 18 inches in diameter, the port would be equal to $\frac{500}{600} \times 0.1 = 0.083$ of the piston area. This is seen to be less than 0.1, as it should be to provide for the lesser piston speed. The 18-inch cylinder having an area of 254.47 square inches, the area of the port will, by the Clark formula, be equal to $254.47 \times 0.083 = 21.2$ inches. Assuming that the port shall have a length equal to 16 inches, the width will be equal to $21.2 \div 16 = 1.325$ inches, or nearly 1⅜ inches. 2. Is it not always advisable to make the steam ports as short as possible? A.—It is not considered good practice to have a short port, for the reason that such a port will give less opening for a given valve travel than a long port. This can be shown by taking the length 16 inches and a travel of 1 inch, from which we get an area of 16 square inches. If now the port was one-half as long, or 8 inches, the port would have, with the same valve movement, an area of 8 square inches only. Several years ago Mr. Wilson Eddy made many practical tests with short ports and found that the length could be reduced greatly from the practice then in vogue. In fact, he found in his experiments that a port could be made only 5 inches long and let steam in and out of a 16 x 22-inch cylinder.

Art of Fine Steel Making.

There is an impression among many people, who read about the wonderful steel used in the manufacture of ancient swords, that the art of steel-making, so far as high quality is concerned, has been lost in modern times. Curious stories are related of the Damascus blades, of the way in which they were made, the process of tempering them, and all their superior qualities; but they have been more than equaled by swords made in this country within the last few years.

N. P. Ames, of Cabotville, Mass., was a famous sword-maker during the war times, and he had great pride in the quality of the sword blades which he forged. To test their quality, in comparison with the best that tradition said were to be found in the world, he visited Spain with specimens of his handiwork; and when the authorities there produced from among the rarest treasures of their armories a sword that was particularly famous, and tested it in his presence, he successfully submitted his samples to tests which were much more severe. It may not be generally known, but it is nevertheless a fact that in no country are better swords made than have been manufactured in the United States for the last seventy years.

The opening exercises at Camden Station, which inaugurated the winter's work at that point and opened the excursion room for use as a reading room, occurred a month ago. The programme was one of the best ever given among many good ones at this place. The speakers were Mr. Wm. Gibson, assistant to general manager, and Mr. Geo. H. Campbell, the terminal agent for Baltimore. Both are Baltimore & Ohio officials who have recently become identified with the road. It is very gratifying to note that they took pronounced ground and spoke very encouragingly of the practical character of the work done by the association."—*B. & O. Y. M. A. Bulletin.*

INDEX TO ADVERTISEMENTS.

Buyers' Finding List.

AIR BRAKE FITTINGS.
Crane Co., Chicago. Ill.

AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR BRAKE GAGE.
Utica Steam Gage Co., Utica, N. Y.

AIR-BRAKE PUMP GOVERNORS.
Foster Engineering Co., Newark, N. J.
Mason Regulator Co., Boston, Mass.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll-Sergeant Drill Co., N. Y. City.
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co. Philadelphia, Pa.
Rand Drill Co., New York.

AIR DRILLING MACHINE.
C. H. Haeseler & Co., Philadelphia, Pa.

AIR HOISTS.
Pedrick & Ayer Co., Philadelphia, Pa.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
H. W. Johns Mfg. Co., New York.

AXLES.
Cambria Iron Co., Philadelphia, Pa.
Gould Coupler Co., Buffalo, N. Y.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

BALANCED SLIDE VALVES.
Am. Bal. Slide Valve Co., San Francisco, Cal.
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.
U. S. Metallic Pkg. Co., Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER CHECKS—INSIDE.
Foster Engineering Co., Newark, N. J.

BOILERS.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Pittsburg Locomotive Works, Pittsburg, Pa.

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BUYERS' FINDING LIST—*Continued.*

BOILER TOOLS.
Richard Dudgeon, New York.

BOILER WASHERS.
Nathan Mfg. Co., New York.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.

BOOKS.
Audel & Co., New York.
H. C. Baird & Co., Philadelphia, Pa.
Philadelphia Book Co., Philadelphia, Pa.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
S. J. Meeker, Newark, N. J.
Paul S. Reeves, Philadelphia, Pa.

BUFFERS.
Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
Williams, White & Co., Moline, Ill.

CARS.
Allison Mfg. Co., Philadelphia, Pa.
J. G. Brill Co., Philadelphia, Pa.
Lima Locomotive & Machine Co., Lima, O.
Ramapo Iron Works, Hillburn, N. Y.

CAR COUPLERS.
Gould Coupler Co., Buffalo, N. Y.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
Sams Automatic Coupler Co., Denver, Col.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

CAR HEATING.
William C. Baker, New York.
Safety Car Heating & Lighting Co., New York.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.

CAR WHEELS.
Krupp (T. Prosser & Son, New York).
Lima Locomotive & Machine Co., Lima, O.
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
Standard Steel Works, Philadelphia, Pa.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHIME WHISTLES.
Crosby Steam Gage & Valve Co., Boston, Mass.
Star Brass Mfg. Co., Boston, Mass.

CLEANING MATERIAL.
India Alkali Works, Boston, Mass.

CLOCKS.
John J. McGrane, New York.

COAL HANDLING MACHINERY.
Ingersoll-Sergeant Drill Co., New York.
Link Belt Engineering Co., Philadelphia, Pa.
The Pratt & Whitney Co., Hartford, Conn.

COAL CHUTES.
Williams, White & Co., Moline, Ill.

CORRESPONDENCE SCHOOLS.
Internat'l Corres. Schools, Scranton, Pa.

CRANES.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia, Pa.
Pedrick & Ayer Co., Philadelphia, Pa.
William Sellers & Co., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANK PIN GAGES.
M. C. Hammett, Troy, N. Y.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

DAMPER REGULATORS.
Mason Regulator Co., Boston, Mass.

DRILLS.
Armstrong Bros. Tool Co., Chicago, Ill.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Pedrick & Ayer Co., Philadelphia, Pa.
The Pratt & Whitney Co., Hartford, Conn.

DRILLING MACHINES.
Gould & Eberhardt, Newark, N. J.
The Pratt & Whitney Co., Hartford, Conn.

ELECTRIC LIGHTING AND POWER APPARATUS.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa

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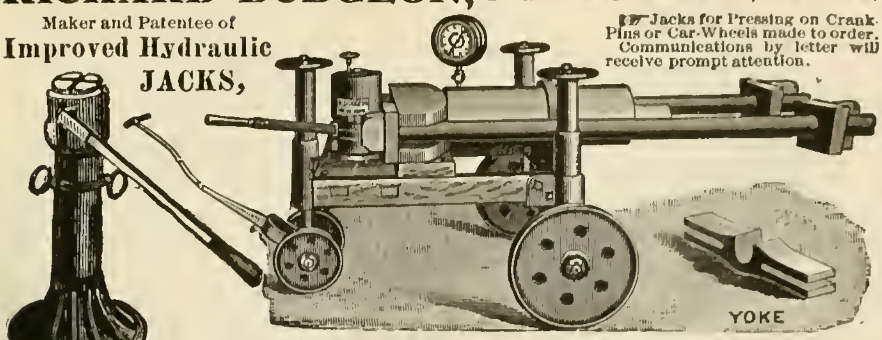

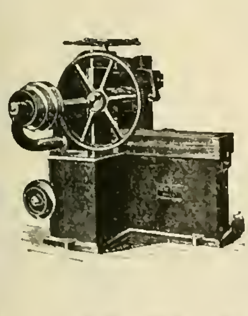

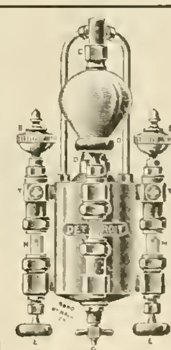

BUYERS' FINDING LIST—*Continued.*

EMERY WHEELS.
N. Y. Belting & Packing Co., New York.

ENGRAVINGS.
Bradley & Poates, New York.

FILES AND RASPS.
Nicholson File Co., Providence, R. I.

FIRE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

FLEXIBLE SHAFT.
Stow Flexible Shaft Co., Philadelphia, Pa.

FLEXIBLE STEAM JOINT.
Moran Flexible Steam Joint Co., Louisville, Ky

FLUES AND TUBES.
Allison Mfg. Co., Philadelphia, Pa.
Tyler Tube & Pipe Co., Washington, Pa.

FORGES.
Buffalo Forge Co., Buffalo, N. Y.
The Bradley Co., Syracuse, N. Y.

FORGING MACHINERY.
Williams, White & Co., Moline, Ill.

FROGS AND CROSSINGS.
Ramapo Iron Works, Hillburn, N. Y.

GRAPHITE.
Jos. Dixon Crucible Co., Jersey City, N. J.

GREY IRON.
S. J. Meeker, Newark, N. J.

HEATING SYSTEM FOR SHOPS.
Buffalo Forge Co.

HOLLOW STAYBOLTS.
Falls Hollow Staybolt Co., Cuyahoga Falls, O.

HYDRAULIC TOOLS.
Richard Dudgeon, New York.
The Watson-Stillman Co., New York.
R. D. Wood & Co., Philadelphia, Pa.

INDICATORS.
Ashcroft Mfg. Co., New York.
Crosby Steam Gage and Valve Co., Boston.

INJECTORS.
Hayden & Derby Mfg. Co., New York.
Nathan Mfg. Co., New York.
William Sellers & Co., Philadelphia, Pa.

JACKS.
E. C. Boyer, Dayton, O.
Richard Dudgeon, New York.
Watson & Stillman, New York.

LAGGINGS FOR LOCOMOTIVES.
H. W. Johns Mfg. Co., New York.

LATHES.
Bement, Miles & Co., Philadelphia, Pa
W. D. Forbes & Co., Hoboken, N. J.
Gould & Eberhardt, Newark, N. J.
Jones & Lamson Machine Co., Springfield, Vt.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.
Newton Machine Tool Wks., Philadelphia, Pa.
Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
William Sellers & Co., Inc., Philadelphia, Pa.

LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Loco. & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa.
Lima Locomotive & Machine Co., Lima, O.
Pittsburg Locomotive Works, Pittsburg, Pa.
H. K. Porter & Co., Pittsburg, Pa.
Richmond Loco. & Mch. Wks., Richmond, Va.
Rogers Locomotive Works, Paterson, N. J.
Schenectady Loco. Wks., Schenectady, N. Y.

LOCOMOTIVE CASTINGS, MODEL.
G. H. Olney, Brooklyn, N. Y.

LUBRICATORS.
Detroit Lubricator Co., Detroit, Mich.
M. C. Hammett, Troy, N. Y.
Nathan Mfg. Co., New York.

LUBRICATING OILS.
Galena Oil Works, Ltd., Franklin, Pa.
Leonard & Ellis, New York.
Signal Oil Works, Franklin, Pa.

MACHINE TOOLS.
Bement, Miles & Co., Philadelphia, Pa.
W. D. Forbes & Co., Hoboken, N. J.
Gould & Eberhardt, Newark, N. J.
Jones & Lamson Machine Co., Springfield, Vt.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.
Newton Machine Tool Wks., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool and Supply Co., New York.
William Sellers & Co., Inc., Philadelphia, Pa.

MALLEABLE CASTINGS.
S. J. Meeker, Newark, N. J.

MECHANICS' TOOLS.
Armstrong Bros.' Tool Co., Chicago, Ill.

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METAL POLISH.
G. W. Hoffman, Indianapolis, Ind.

METAL SAWING MACHINES.
Armstrong Mfg. Co., New York.
Newton Machine Tool Works, Phila Pa
Pratt & Whitney Co., Hartford, Conn.
Q. & C. Co., Chicago, Ill.

MILLING MACHINES.
Newton Machine Tool Works, Phila., Pa.
Pedrick & Ayer Co., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

MOLDING MACHINES.
Tabor Mfg. Co., New York City.

OVER CLOTHES
H. S. Peters, Dover, N. J.

PACKING.
Boston Belting Co., Boston, Mass.
Gould Packing Co., East Cambridge, Mass.
H. W. Johns Mfg. Co., New York.
Jenkins Bros., New York.
N Y Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.
U. S. Metallic Packing Co., Philadelphia, Pa.

PAINTS.
Detroit Graphite Mfg. Co, Detroit, Mich.
H. W. Johns Mfg. Co., New York.

PATENTS.
O. Knight, New York.
John Wedderburn & Co., Washington, D. C.
George P. Whittlesey, Washington, D. C.

PERFORATED METAL.
A. J. Beckley & Co., Meriden, Conn.
Harrington & King Perforating Co., Chicago, Ill.
The Hendrick Mfg. Co., Ltd., Carbondale, Pa.

PHOTOGRAPHS.
F. Moore, London, Eng.

PIPE THREADING AND CUTTING MACHINERY.
Armstrong Mfg. Co., Bridgeport, Conn.
D. Saunders' Sons, Yonkers, N. Y.

PISTON RODS.
Cambria Iron Co., Philadelphia, Pa.
B. M Jones & Co., Boston, Mass.
Thomas Prosser & Son, New York.

PNEUMATIC TOOLS.
C. H. Haeseler & Co., Philadelphia, Pa.
Pedrick & Ayer Co, Philadelphia.
U. S. Metallic Packing Co., Philadelphia.

PRESSURE REGULATORS.
Foster Engineering Co., Newark, N. J.
Newark Regulator Co., Newark, O.

PUMP VALVES.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

PUNCHING AND SHEARING MACHINERY.
Williams, White & Co., Moline, Ill.
R. D. Wood & Co., Philadelphia, Pa.

PUSH CARS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

RAILWAY FENCES.
Page Woven Wire Fence Co., Adrian, Mich.

REGULATORS.
Mason Regulator Co., Boston, Mass.

RETAINING RINGS.
Ramapo Wheel & Foundry Co., Ramapo, N.Y

RUBBER.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

SAFETY VALVES.
Ashton Valve Co., Boston, Mass.
Coale Muffler and Safety Valve Co., Baltimore, Md
Consolidated Valve Co., Bridgeport, Conn.
Crosby Steam Gage & Valve Co., Boston, Mass.
Star Brass Mfg. Co., Boston, Mass.

SANDING APPARATUS.
Henry L. Leach, North Cambridge, Mass.
Sherburne & Co., Boston, Mass.

SHAFTING.
American Tool & Machine Co., Boston, Mass
William Sellers & Co., Philadelphia, Pa

SPARK ARRESTER PLATE.
A. J. Beckley & Co., Meriden, Conn.
Harrington & King Perforating Co., Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.

SPRINGS.
A. French Spring Co., Pittsburg, Pa.

SPRING STEEL.
Thomas Prosser & Son, New York.

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BUYERS' FINDING LIST—*Continued.*

STAYBOLTS.
Falls Hollow Stay-Bolt Co., Cuyahoga Falls, O.
B. M. Jones & Co., Boston, Mass.

STEAM GAGES.
Crosby Steam Gage & Valve Co., Boston.
Star Brass Mfg. Co., Boston, Mass.
Utica Steam Gage Co., Utica, N. Y.

STEAM HAMMERS.
Bement, Miles & Co., Philadelphia, Pa
R. Dudgeon, New York

STEAM HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

STEAM PUMPS.
A. S. Cameron Steam Pump Works, New York.

STEEL.
Cambria Iron Co., Philadelphia, Pa.
Carbon Steel Co., Pittsburgh, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).
Latrobe Steel Co., Latrobe, Pa
Shoenberger Steel Co., Pittsburg, Pa.

STEEL SURFACE CATTLE GUARDS.
Kalamazoo Railroad Velocipede & Car Co., Kalamazoo, Mich.

STEEL TIRED WHEELS.
Krupp (T. Prosser & Son, New York).
Ramapo Wheel & Foundry Co., Ramapo, N.Y.
Standard Steel Works, Philadelphia, Pa.

STEEL TIRES.
Latrobe Steel Works, Latrobe, Pa.
Krupp (T. Prosser & Son, New York).
Standard Steel Works, Philadelphia, Pa

STEEL TRUCK FRAMES.
Fox Solid Pressed Steel Co., Chicago, Ill.

STOCKS AND DIES.
Armstrong Mfg. Co., Bridgeport, Conn.
Pratt & Whitney Co., Hartford, Conn.

STREET RAILWAY SUPPLIES.
J. G. Brill Co., Philadelphia, Pa.

SWITCHES.
Ramapo Iron Works, Hillburn, N. Y.

TIE PLATES.
Q. & C. Co., Chicago, Ill.

TIRES.
Krupp (T. Prosser & Son, New York).
Latrobe Steel Co., Philadelphia, Pa.

TOOL HOLDERS.
Armstrong Bros. Tool Co., Chicago, Ill.
Gould & Eberhardt, Newark, N. J.

TOOL STEEL.
B. M. Jones & Co., Boston, Mass.

TRUCKS.
J. G. Brill Co., Philadelphia, Pa.

TUBE EXPANDERS.
R. Dudgeon, New York.

TURNBUCKLES.
Cleveland City Forge & Iron Co., Cleveland, O.

TURRET MACHINES.
Jones & Lamson, Springfield, Vt.

TWIST DRILLS.
Cleveland Twist Drill Co., Cleveland, O.

VALVES.
Ashton Valve Co., Boston, Mass.
Coale Muffler and Safety Valve Co., Baltimore, Md
Crosby Steam Gage & Valve Co., Boston, Mass.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.
Star Brass Mfg Co., Boston, Mass.

VALVES, REDUCING.
Foster Engineering Co., Newark, N. J.
Ross Valve Co., Troy, N. Y.

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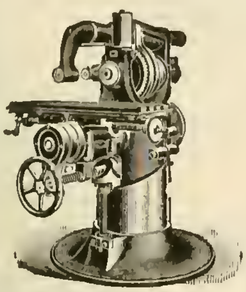

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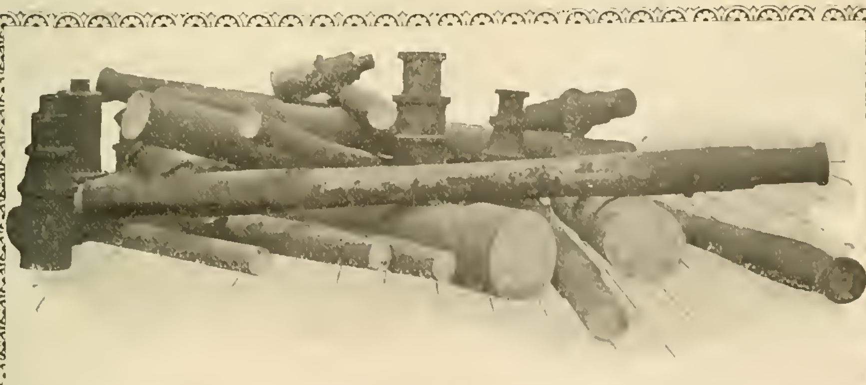

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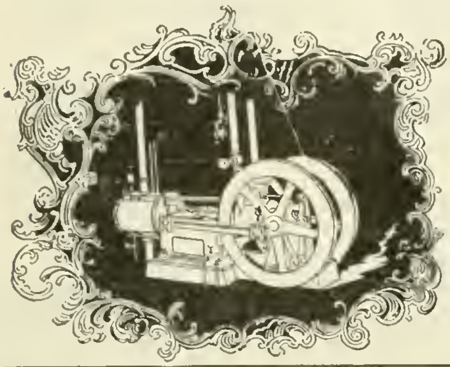

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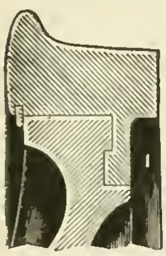

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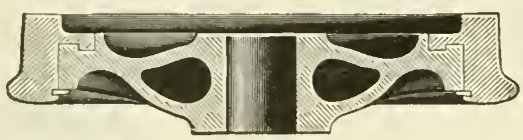

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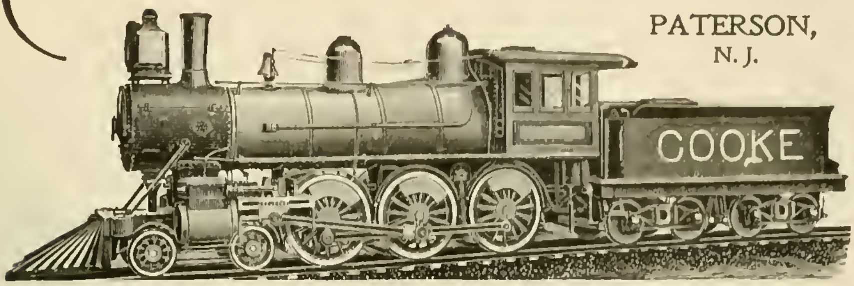

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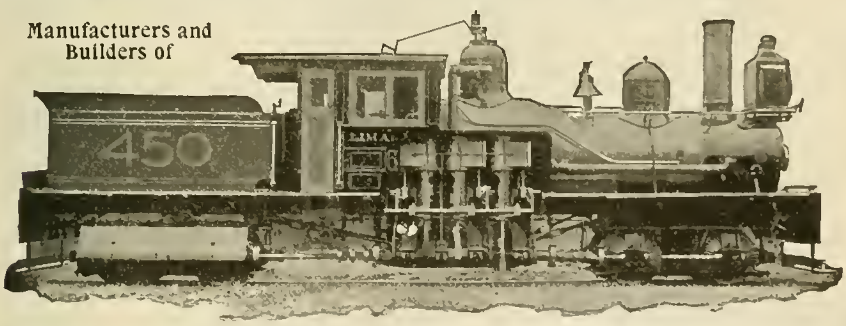

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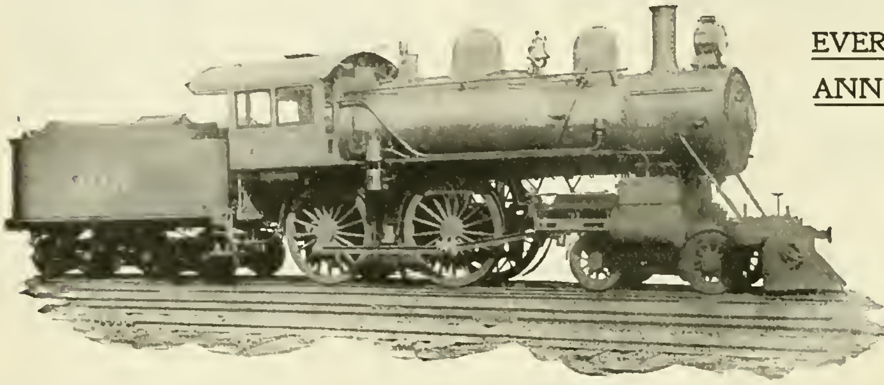

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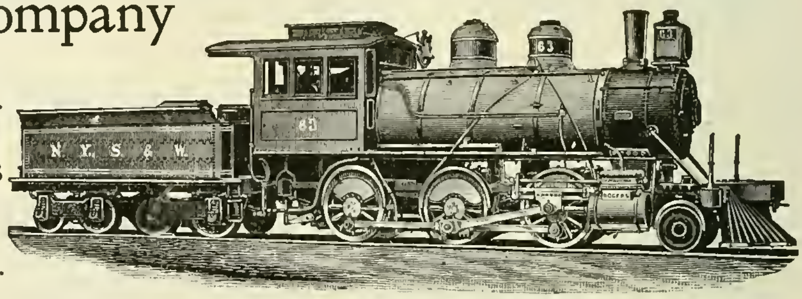

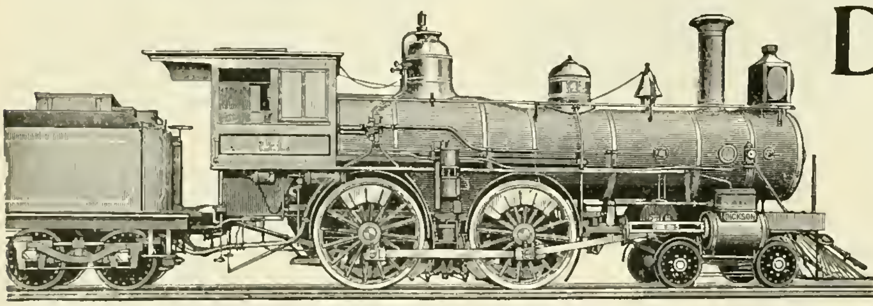

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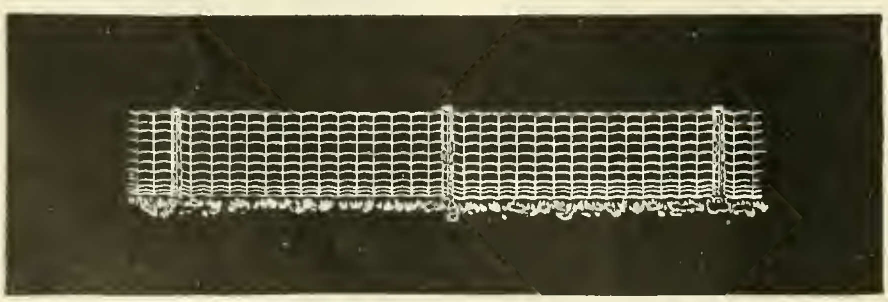

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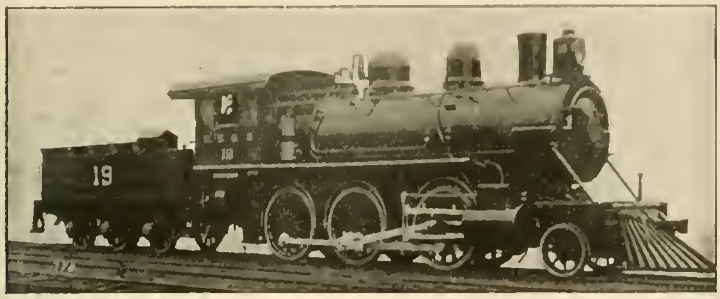

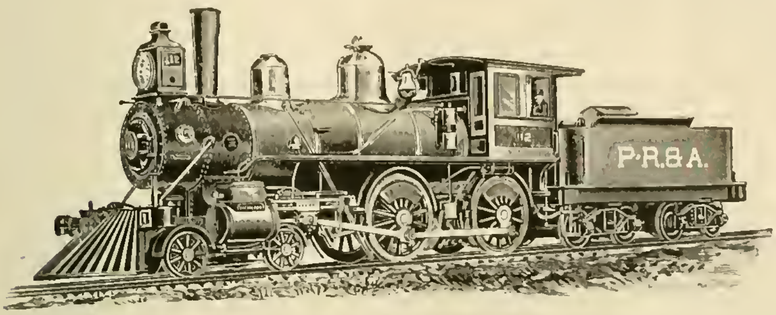

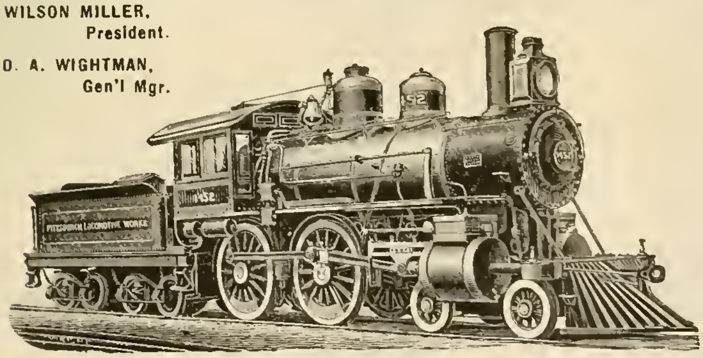

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Vol. X. NEW YORK, MARCH, 1897. No. 3.

Mill Valley and Mount Tamalpais Scenic Railway.

Looking from San Francisco northwest, across the bay, we see a rugged plot of mountains, among which rises Mount Tamalpais, which, Robert Louis Stevenson said, "stands sentry like a light-house over the Golden Gate, between the bay and open ocean, and looks down indifferently on both."

The people of San Francisco have a natural desire to visit the summit of that picturesque mountain, and their wishes in this direction led to the building of the railroad shown in the annexed engravings.

Mr. Charles E. Stocker, an engineer on the road, to whom we are indebted for the photographs from which our engravings were made, writes us:

"The road is 8¼ miles in length, the first mile being practically level and through a beautiful grove of redwoods. There are 270 curves and twenty-one trestles. Three trestles have a radius of 70 feet; four have a radius of 100 feet; four have a radius of 80 feet; two a radius of 140 feet; one has a curvature of 30 degrees, and one 17 degrees, and two are straight.

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"There is one place on the road in which the track forms a figure 8, and if standing on a point above it, you can see across five tracks. Along the route are numerous streams of water. It crosses a number of cañons in which are mammoth redwoods. About 200 feet below the top of the mountain a hotel has been erected.

"Looking from the top of the mountain, you can see toward the west the Pacific ocean and San Francisco bay; to the east, San Rafael and the Sonoma valley; and to the north, the snow-capped Sierras. The elevation of the road is 2,355 feet above the sea level.

"There are two locomotives on the road. One is the 'Heisler,' designed by William Heisler and built by the Stearns Manufacturing Company, of Erie, Penn. She weighs 35 tons; has two cylinders, one on each side—diameter, 14 inches by 12-inch stroke—connected to a shaft running through the center and geared to front and back axle, and driving wheels connected with side rods. This engine is equipped with the modern Westinghouse automatic air brakes, and a Sweeney emergency and water brake. She is built for burning wood and coal.

"The other engine is a Shay patent direct-connected locomotive, built by the Lima Locomotive & Machine Works.

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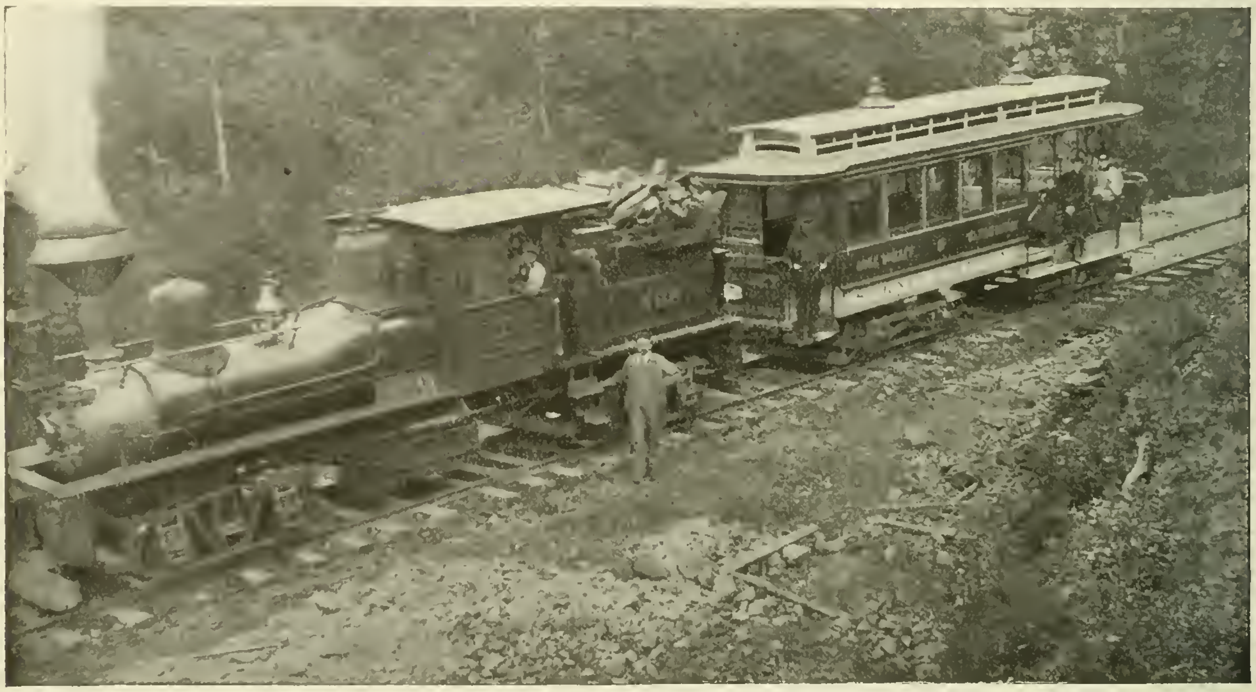
She has three cylinders 8 x 8, connected to a shaft on one side and geared to the driving wheels. She is equipped with a steam brake and built for burning wood and coal. This engine weighs 20 tons. The engineer is E. Thomas.

"These engines will push from two to three observation cars up at a trip.

"Mill Valley is a beautiful summer resort, situated at the base of the mountain, and is about 12 miles from San Francisco by rail and water.

"I send you pictures of the 'Heisler' and of the hotel, and also a picture of the 'Shay' on level track."



MOUNTAIN-CLIMBING SHAY LOCOMOTIVE.

The Slow-Running Water-Stand Pipe.

We have repeatedly commented upon the subject of delays caused to fast trains at water stations owing to the use of inadequate openings in the water stands and station tanks, and it appears that this line of railroad appliances has been the last to feel the touch of improvement. While railroad men have been devoting zealous attention to providing the means for getting trains over the road with the utmost dispatch, the unnecessary time spent at stations, taking water, has apparently been overlooked. We know water stations on important railroad systems where the stand pipes are too low for modern tenders, and the greatest difficulty is experienced in obtaining the supply of water required.

A rather interesting discussion took place lately in connection with a paper on "Water Supply Stations," during the course of which one speaker said: "It is the rule to find an engine stopping four minutes to take water on an express train, and there are probably not half-a-dozen railroads in the country that are not losing more than two minutes at each stop for water, and why? Merely because the subject has attracted attention only during the past year, when the demand for speed has made it necessary for some official to add this to his other numerous burdens. To neglect it was all right as long as the reports came in from the conductors that they were delayed at the station two or three or four minutes to oil up, and this at every station stopped at.

"But recently we hear a new doctrine promulgated that stops for oiling to exceed one minute in duration are not necessary, and some say they are not necessary at all within distances of 150 miles, the claim being made that oiling can be done on the engine. This brings the water question onto the water man, where it belongs, and places the full responsibility on his shoulders. He has escaped notice so far. He is usually a quiet, modest fellow, who makes but little noise. He is likely to be soon promoted to a more responsible position, and when the reports commence to come in that a train was delayed at Station X on account of the water man, we shall see signs of life, and some very sudden signs, too, in that department. It is more than likely that the general manager will want to know why these delays are necessary. The water man will retaliate, saying that he is doing the best that he can with the stingy appliances which the road has given him. It is then proper for the general manager to ask how long these appliances have been in use, and when he hears the answer, there will probably be an appropriation made for betterment in this respect.

"The tenders of our large locomotives to-day will require about 3,000 gallons of water at each tank stop. The appliances can be had for delivering this at the rate of 4,000 gallons a minute, and faster if it should be found that this time should be cut down to three-quarters of a minute. It is simply a question of quantities, velocities and friction—a mere problem in arithmetic."

The School at Huntington Shops—Chesapeake & Ohio Railway.

There is a school at the Huntington shops, for apprentices employed there, under the patronage and fostering care of the railway management, which has fitted up commodious quarters for the purpose, and supplied them with drawing-boards, lights, T-squares, angles, paper, and in fact all accessories for successfully pursuing a course of primary instruction. This is all free to the attendants, a nominal sum only being charged for tuition.

Mental pabulum is furnished by Mechanical Engineer J. J. Ewing, a graduate of Cornell, who is thoroughly conversant with the requirements of a tutor for such a course of instruction, having had an extensive shop experience to round out and finish his theoretical training.

Drawing, with the principles of projection and the development of surfaces, is receiving the most ardent attention from these ambitious students, so earnestly striving to fit themselves for a higher place. Free-hand sketching is taught, and the more advanced scholars work up the drawings from their own sketches, made from parts of a locomotive on which they may be engaged in the shop. This is a good procedure to keep interest in the studies alive, as we know from the standpoint of both scholar and tutor.

The course at present embraces the

above work of two evenings a week, but will later include a drill in physics and mechanics. A. F. Stewart, the master mechanic, is exercising a fatherly interest in his boys, and leaves nothing undone that will be likely to advance them in their studies. General Foreman Elvin is making a strong effort to get the Pedrick & Ayer valve-motion model to place in the instruction room, so that he can lead the young idea into the intricacies of the movements of the slide valve. This policy is one of the best to encourage the learners in correct paths, and reflects credit on one of the rising young foremen, who has shown by his record that he is not a drone in the hive.

It is not intended or expected that this help for the apprentices will turn them out into the world fitted to cope with the problems of mechanical engineering; the only object is to put before them opportunities to improve themselves. Some will profit by the opening; others will fail. That is the history of all similar moves. Superintendent of Motive Power Morris is laying a foundation for the future of these boys; it remains for them to make the most of it.

Speeds and Feeds.

At the Richmond shops of the Chesapeake & Ohio Railway, the question of speeds and feeds is given the closest attention by General Foreman Gould. If there are any at this time who entertain doubts as to the influence of these two important factors in the output of a shop, they may be easily dispelled by a little experimenting along the lines noted.

In the matter of car wheels—and, by the way, there are few shops where the subject of wheels is not a live issue, since nearly all are chronically behind in their orders—a revolution can be worked by speeding up, or increasing the feed, or both. It has been done in the above shop to the extent of doubling the product of an antiquated machine.

The old tool could never be made to yield up more than 20 wheels in 10 hours, until it was speeded up to the limit of endurance of the cutter, when 50 wheels per day were forthcoming regularly. The wheel platform is now constantly filled, whereas, before there was never a wheel in sight. Driving-box brasses, which are here bored on a mill, suffered from the same blight until the remedy was applied. Nobody is asked to sacrifice himself on the altar of his duty by this policy; the tools are simply made to do what they were designed for, to furnish a good reason for their continued existence in the shop. When they fail in this by intelligent management, the scrap pile should claim its own.

The committee of the Traveling Engineers' Association, of which I. H. Brown, Covington, Ky., is chairman, has set to work investigating "The Operation of Lubricators under High Steam-Chest Pressure, and other Automatic Appliances for Oiling Cylinders and Valves." There has been so much trouble with automatic lubricators since steam pressures were raised above 140 pounds per square inch, that exact information, regarding the failure of the lubricators to deliver the oil in the cylinders, is badly wanted. The committee sends out ten questions to be answered, which will elicit important information, if the members of the association do their duty in the premises. We urge that the committee's circular receive prompt attention, and that members shall make experiments, if necessary, to help out with the work.

An English export firm has just sent to London a good-sized shipment of hydraulic jacks and other special railroad tools. They claim that their shipments last year for special railroad supplies were larger than for five years past. According to present indications, a considerable quantity of iron-working tools will be sent to English markets from the United States this year. "In referring to these tools," said the exporter, "we do not mean to infer that bicycle tools are included. This class of American machinery, it is well known, leads all foreign makers, and their principal export markets are in Europe."

MOUNTAIN-CLIMBING HEISLER LOCOMOTIVE.

Compound Twelve-Wheeler—Northern Pacific Railway.

The half-tone illustration of the "Mastodon" represents one locomotive of an order now being built for the Northern Pacific Railway by the Schenectady Locomotive Works. The vastness of the proportions of this engine are hardly realized at first glance, but with the figure of Mechanical Engineer Sague in the picture as a base of comparison, the immensity of the machine looms prominently forth; the low-pressure cylinder in particular, lending the impression of pent-up power.

NORTHERN PACIFIC TWELVE-WHEELER.

Among some of the details that will catch the eye of the observer, are the sandboxes, one at either end of the boiler, with their pipes extending down at the front and rear wheels. The valve rod on an incline will also be pronounced an innovation in the construction of to-day; these were so made in order not to have rockers of inordinate length; to do this the valve seats are on an angle with the cylinder bore. Extended piston rods are used, and will no doubt be found a good thing in preventing undue cylinder wear. Contrary to usual practice in these leviathans of the rail, the boiler head does not extend to the back end of the cab, but comes just through the front, as in the case of the standard engines, leaving a fine roomy cab with the handiest appointments for the comfort and convenience of the runner and fireman.

These engines are counterbalanced in accordance with the recommendations of the committee of the American Railway Master Mechanics' Association at the 1896 convention, and it is fair to assume that these are the only heavy engines in this country with a counterbalance that can make any pretence to accuracy as viewed by those who know what accuracy means in this connection. The close approach to ideal counterbalancing was made possible in the present instance by reason of the lightest construction of reciprocating parts, and also because of the steel wheels which enable the builders to introduce the metal where it was required.

On trial runs with loads on Schenectady hill, this engine indicated 1,200 horse-power at a speed of 18 miles per hour. The performance ahead of heaviest available loads, not, however, requiring the maximum tractive effort of the engine, was in every respect highly satisfactory, we are informed by Mr. A. J. Pitkin, the superintendent of Schenectady Locomotive Works.

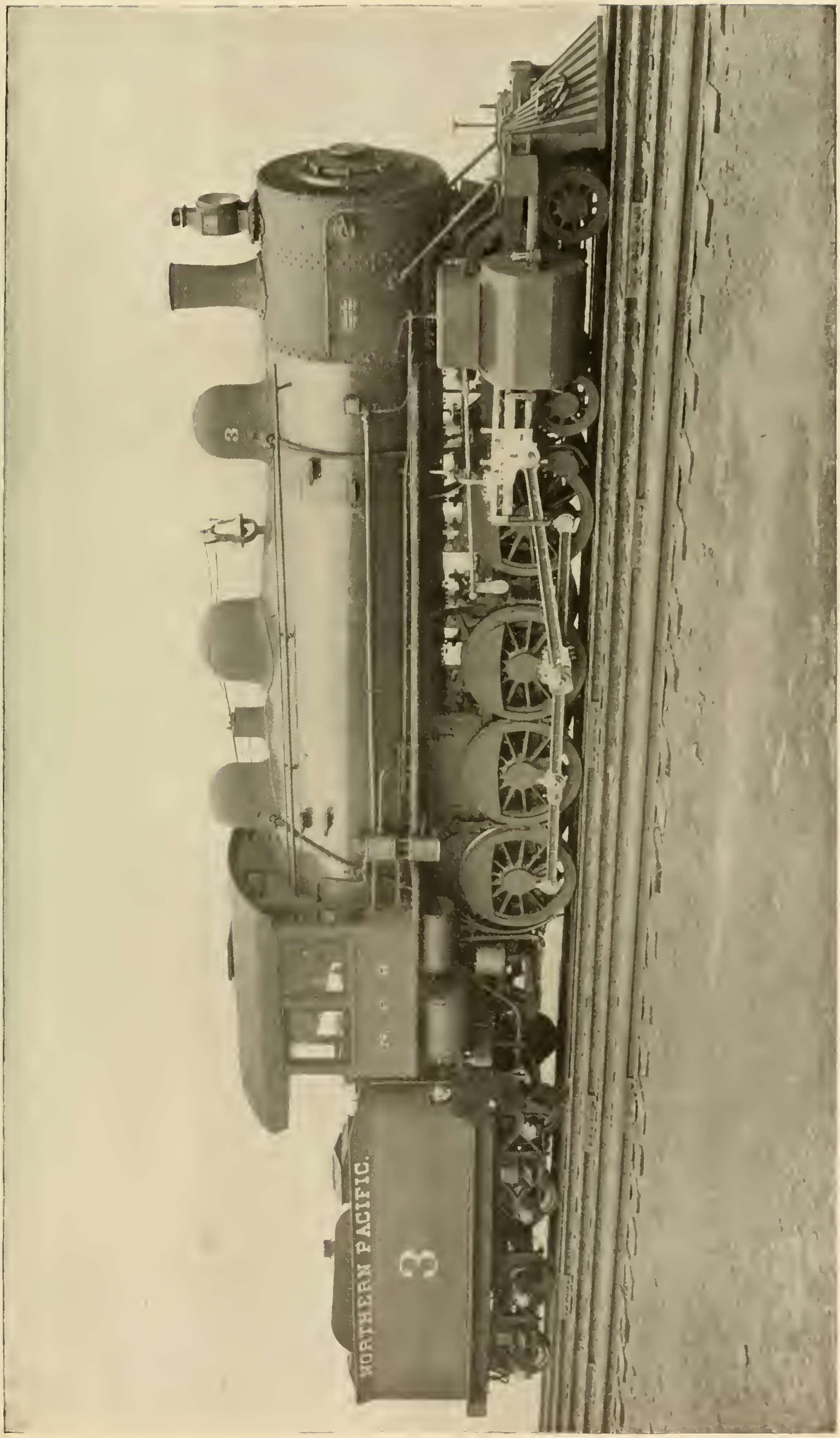
The receiver pipe has a cubic capacity of about 1½ times that of the high-pressure cylinder, and is ribbed inside and out for the purpose of absorbing and diffusing a greater number of heat units than any other design is capable of. The horizontal seams of the boiler are sextuple-riveted with welt strips inside and outside, and have an efficiency by test of 85 per cent. of the solid sheet. All firebox sheets are drilled in pairs, and the holes are afterward reamed to size while in place; this manner of doing work, however, is standard and does not have to be specified. To further show the good character of the work on the boilers, it may be mentioned that all mud rings are planed on edges and milled at the corners inside and out, and the bottom section of the dome ring is bored out and turned on the edges before flanging, so as to insure perfect calking edges.

The mechanism for working the engine simple or compound is the well-known Pitkin system, changing from compound to simple by the movement of a small lever, and running in either system at will and for any period. There is one good feature noticeable in the sector, in the fineness and number of teeth for the reverse lever latch; they are about ½ inch pitch and placed the whole length of the sector.

The heaviest power on the Northern Pacific, prior to the purchase of these engines, was 22 x 28 simple consolidations, having an adhesive weight of 135,000 pounds, and a total weight of 150,000 pounds. The compounds have adhesion of 150,000 pounds and a total of 186,000 pounds. These figures will be interesting to those following the development of heavy power, as these engines have an adhesion equal to the total weight of those so long considered big fellows.

All work on this new power is of the highest character, and fully up to the

(*Continued on page 222.*)



NORTHERN PACIFIC TWELVE-WHEELER, THE HEAVIEST LOCOMOTIVE EVER BUILT.

standard established by the builders, stamping them as ranking second to none. The following items will furnish a good general idea of dimensions and give most particulars of interest:

Type—Twelve-wheeler.
Simple or compound—Compound.
Gage—4 feet 8½ inches.
Fuel—Bituminous coal.
Steam pressure—200 pounds.
Diameter of cylinders—H. P. 23 inches, L. P. 34 inches.
Stroke—30 inches.
Horizontal thickness of pistons—4¾ and 5¾ inches.
Diameter of piston rods—3¾ inches.
Size of steam ports—H. P. 20 x 2⅛ inches, L. P. 23 x 2⅛ inches.
Size of exhaust ports—H. P. 20 x 3 inches, L. P. 23 x 3 inches.
Size of bridges—1⅜ inches.
Kind of valves—Allen-Richardson.
Greatest travel of valves—6½ inches.
Outside lap of valves—1⅛ inches.
Inside clearance of valves—Both cylinders ¼ inch.
Diameter of driving wheels over tires—55 inches.
Material of wheel centers—Cast steel.
Driving-wheel base—15 feet 6 inches.
Rigid wheel base—15 feet 6 inches.
Total wheel base—26 feet 4 inches.
Total wheel base of engine and tender—53 feet 8 inches.
Total length over all—62 feet 1 inch.
Engine truck wheels, diameter—28 inches.
Engine truck wheels, kind—Steel tired, cast iron, spoke center.
Adhesive weight—150,000 pounds.
Weight in working order—186,000 pounds.
Weight of tender loaded—81,300 pounds.
Total weight of engine and tender—267-300 pounds.
Driving box material—Cast steel on main axle, others steeled cast iron.
Diameter and length of driving journals—9 inches long on main axle, 8½ diameter by 10 inches on others.
Diameter of main crank pin journals—6½ inches, by 6 inches long.
Diameter of main crank pin for side rods—7 inches by 5¼ inches long.
Diameter of side rod crank pin journals—Intermediate, 5½ inches by 5 inches. Front and back 5 inches diameter by 3¾ inches long.
Brakes, driver—American, on all wheels.
Brakes, water—Le Chatelier.
Brakes, tender and train—Westinghouse automatic. 9½ inch air pump.
Air signal—Westinghouse.
Safety valves—Three, 3 inch Ashton pops.
Insulation—Magnesia sectional covering on boiler, dome and cylinder.
Sanding device—Dean's.
Brake beams—Kewaunee reversible.
Blow-off cock—McIntosh.

BOILER.

Type—Extended wagon-top.
Material—Carbon steel.
Outside diameter at small ring—72 inches.
Thickness of plates—½, 11/16, 13/16, ⅞, ¾, ⅝ and 9/16 inch.
Horizontal seams—Butt joint, sextuple riveted, with welt strips inside and outside.
Circumferential seams—Double riveted.
Firebox, length inside—120 9/16 inches.
Firebox, width inside—42 inches.
Firebox, depth—Front 77 inches. Back 73½ inches.
Firebox material—Carbon steel.
Firebox plates, thickness—sides 5/16 inch, back 5/16 inch.
Crown sheet, thickness—⅜ inch.
Tube sheets, thickness—½ inch.
Water space—Front 4¼ inches, sides 3½ to 4 inches, back 3½ to 4 inches.
Crown stays, kind—Radial bolts 1⅛ inch diameter.
Firebox staybolts, kind—Iron, 1 inch diameter.
Tubes, material, charcoal iron, No. 12 W. G.
Tubes, number of—332.
Tubes, diameter—2¼ inches.
Tubes, length over tube sheets—14 feet.
Firebrick, supported on water tubes.
Heating surface, tubes—2721.6 square feet.
Heating surface, water tubes—15.3 square feet.
Heating surface, firebox—206.51 square feet.
Total heating surface—2943.41 square feet.
Grate area—35 square feet.
Exhaust pipes, type—Single, high.
Exhaust nozzles, diameter—5¼, 5½ and 5¾ inches.
Smokestack, inside diameter—18 inches at top, 16 inches near bottom.
Smokestack, from rail to top—14 feet.
Boiler supplied by two Sellers' Improved Class M, No. 10½ injectors.

TENDER.

Frame, kind—10-inch steel channels.
Truck—4-wheeled, channel iron, center bearing; side bearing on back truck.
Wheels, kind—Cast iron, plate.
Wheels, diameter—33 inches.
Journals, diameter and length—4½ by 8 inches.
Wheelbase—15 feet, 3 inches.
Water capacity—4,000 U. S. gallons.
Coal capacity—7½ (2,000 lb.) tons.

Protest Against Increasing Duty on Steel.

It is quite a novelty to find American manufacturers making protest to the Ways and Means Committee of Congress against increasing duties on the productions they make, but this has lately been done by one of America's largest steel makers.

The statement sent to the Ways and Means Committee says that the chief importer of tires from abroad into this country is Frederick Krupp, of Essen, and the tires of that maker are invariably sold at much higher figures than prices charged by American makers, and this business would not be in anywise affected by any tariff legislation. Any slight increase in the business of this foreign corporation that may have taken place of late years, is not due to the action of the Wilson Bill, but to the superior ability of their New York agents, in distributing the Krupp product, owing to a change in the personnel of the firm of these agents, by which younger men have come to the front and assumed the management of the agency.

The rate on steel castings is more than sufficient for the protection of this branch in the United States, which is best evidenced by the fact that castings made of steel are sold in England at between 30 and 50 per cent. higher prices than obtained in this country, and in France at over 100 per cent. higher prices than prevail in the United States.

Traveling Engineers' Committees for 1896-97.

1st. The Brown system of discipline, its operation and methods used. Chairman—G. W. Gould, of M., St. P. & S. Ste. M. R. R.

2d. The operation of lubricators under high steam-chest pressure, and other automatic appliances for oiling cylinders and valves. Chairman—I. H. Brown, of C. & O. Ry.

3d. The care, maintenance and economical operating of metallic packing. Chairman—J. A. Gibson, of C., C., C. & St. L. Ry.

4th. How should a locomotive be operated to secure the most economical use of steam and fuel, speed and weight of train to be considered? Chairman—W. E. Widgeon, of The Vandalia.

5th. The injector, the difficulties met in its operation, and best remedies for the troubles. Chairman—J. W. Hall, of St. L., S-W. of Tex. R. R.

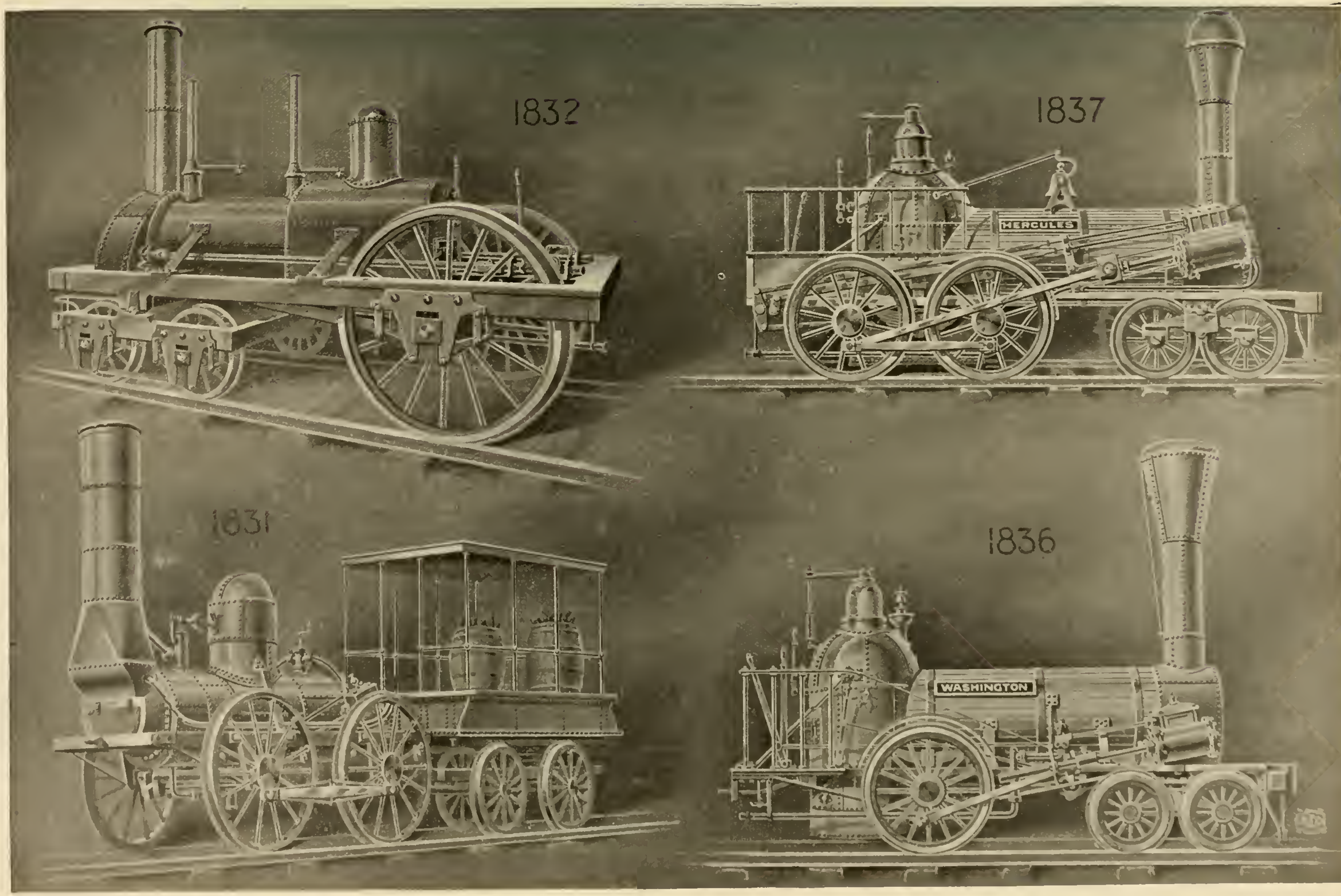
6th. The preparation of coal for use on locomotives, and proper tools to be furnished. Chairman—D. R. McBain, of Mich. Cent. Ry.

7th. Is the brick arch an economical adjunct to a locomotive? Chairman—John Donovan, of Vt. Cent. R. R.

8th. The duties of engine and trainmen in testing air-brake equipment on engines and trains. Chairman—D. C. Woods, of C., R. I. & P. Ry.

9th. Repairs and adjustment of air-brake equipment while on the road. Chairman—T. A. Hedendahl, of Union Pac. Ry.

10th. Air-brake instructions by the traveling engineer while on the road. Chairman—M. M. Meehan, of D., S. S. & A. R. R.



1832. The "Experiment." John B. Jervis. First engine with four-wheeled truck.

1831. "De Witt Clinton." John B. Jervis. First locomotive run in New York State.

GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 3.

1837. "Hercules." Eastwick & Harrison. First locomotive with equalizers.

1836. "Washington." Richard Norris. First of a class.

Railway Mail Service.

One of the most efficient sub-departments of the Government is that which deals with the transportation of the mails over railroads. From a report of the general superintendent of the Railway Mail Department for the year ending June, 1896, we find that the total number of full post-office cars was 778. The Post-Office Department has been urging for years that the cars carrying mail should be equipped with all the appliances necessary for securing safety, and the report intimates that great progress had been made during the last year. About 27 per cent. of the cars are equipped with the Pintsch light, which the department favors as the best and safest light that has been tried, and 40 per cent. of the cars are heated by steam.

As a result of these improvements in the construction and equipment of post-office cars, there has been a decided falling-off in the number of clerks killed or injured, and in the amount of mail matter destroyed or damaged during the year, notwithstanding the fact that nearly as many accidents occurred as formerly. For the year ending June 30, 1896, there were 495 casualties, in which five clerks were killed, 42 seriously injured and 65 slightly injured—a decrease of 68 in the number of killed and injured, while the number of clerks employed in the service was greater than ever before. In the detailed list of casualties given in the report, we notice that there are fewer instances than formerly of damage to mail matter by oil from the lamps, or its destruction by fire originating from the lamps or from the stoves. Three cases of fire occurred which were directly traceable to the oil lamps, 8 to the stoves, and 8 from unknown sources, in all of which considerable mail matter was destroyed, thereby entailing much loss and great annoyance on both public and private interests; and in 32 additional cases, mail matter was more or less seriously damaged by oil from the lamps.

Horizontal Oscillation of Locomotives.

A correspondent in Altoona, Wis., writes us at some length, giving his views on the cause of the "nosing" or horizontal oscillation of locomotives. He argues that the peculiar disorder referred to is not in any way connected with the counterbalance, but to the tendency of the forward pair of truck wheels in one engine running to one side. It strikes the rail on one side and is then projected off towards the other rail, and by this means sets up the oscillation which is found so disagreeable and dangerous.

Our correspondent may be correct in regard to some engines, but it is generally acknowledged that defective counterbalance and want of lateral stiffness in the frames is the most common cause of horizontal oscillation.

Frank Thomson—From Machinist Apprentice to President.

It is the pride and glory of American mothers that a son to them born may be President of the United States; the mothers of American railroad boys may entertain with reason the hope that one of their sons may rise to be president of the railroad. There are few railroad presidents in America who have not risen from the lower ranks by the force of native energy, so that the prizes are nearly as numerous as the number of railroad companies; yet it is only a fortunate few who reach the pinnacle of an enterprising railroad boy's ambition.

The latest man to reach the top, and that, too, of the greatest railroad in the world, was Frank Thomson, who climbed step by step from machinist apprentice to the presidency of the Pennsylvania Railroad. There are few men with the railroad strain in their blood who would prefer being President of the United States before being head of the Pennsylvania Railroad.

Mr. Thomson rose slowly by well-earned steps, and it is safe to say that there is no work about a railroad that he does not understand as well as the men who are doing it. He entered the Altoona shops as an apprentice in 1858, and was the first of the technically educated apprentices for which the Pennsylvania Railroad is now distinguished. Mr. Thomson was not technically educated in the way that modern engineering college graduates are, but he had received a high-school education, which was a very unusual thing in those days with youths who were willing to learn mechanical trades. He was, however, of a sturdy Scotch stock, with an inheritance of push qualities. Mr. Andrew Carnegie, who was secretary to Col. Thomas A. Scott when Mr. Thomson entered the shops at Altoona, told the writer, that the secret of Mr. Thomson's steady rise was his determination to understand every detail of his work. His superior education, which was kept up by private study, also helped in no small degree.

Six years after entering the Altoona shops, Mr. Thomson was chosen by Col. Scott as his assistant in the management of the railroad military service for the Government. He performed his duties so satisfactorily that he was shortly afterwards promoted to be superintendent. Then for a year he was superintendent of motive power, and from that was advanced to be general manager. A gentleman who is intimately acquainted with Mr. Thomson remarked that the way he performed the duties of general manager stamped him as a leader among the ablest railroad men.

Mr. Thomson was not favored by potentialities of birth and backing more than hundreds of young men who are working at the vice bench to-day. His life is "a guide, a buckler, an example," that ought to encourage the most lowly of our railroad boys to "take heart again," and make the top their goal.

MR. FRANK THOMSON, PRESIDENT PENNSYLVANIA RAILROAD.

Dissolution of the Steel Rail Trust.

For a number of years the makers of steel rails have kept up the price of their product by means of a trust which regulated prices. Trusts contain within themselves the elements of dissolution, and the steel rail trust obeyed the law of nature last month and died. There was a peculiarity about this trust that is unique in the history of such combinations. We have the authority of the head of the largest steel making company in the country for saying that the rail trust was organized by railroad men and practically managed by the late President Roberts, of the Pennsylvania Railroad.

Several years before the steel rail trust was formed ten years ago, there were fourteen concerns in the country making steel rails, and competition was waged so fiercely that eight of them dropped out of existence, and there were indications that several of the six remaining companies would also have to fail. The Pennsylvania Railroad Company was very much interested in the prosperity of the steel-making plants, for three of the largest works were on their road, and a fourth one at Chicago which had to transport its coke from Pennsylvania. Disaster to the steel rail industry meant disaster to the Pennsylvania Railroad, and President Roberts conceived the idea of forming a trust for the maintenance of living prices. He succeeded in obtaining the co-operation of President Vanderbilt of the New York Central, and of President Sloan of the Delaware, Lackawanna & Western, who were both interested in keeping the steel-making industries prosperous, and the three prevailed upon the steel makers to form the trust.

President Roberts went to one of the steel-making plants in which his company was directly interested, and found out the exact cost of making a ton of steel rails. To that he added $3 for profit, and established the selling price of rails on that basis. Throughout years of highly fluctuating conditions, Mr. Roberts contrived to prevent the different members of the trust from violating the agreement, but he often had great difficulty in doing so.

Since the beginning of Mr. Roberts' illness, the trust has been without a guiding head, and there has been a good deal of discord. Mr. Sloan, one of the presidents who helped establish the trust, gave it a blow which ended in dissolution. He wanted to buy rails, but refused to pay $25 per ton for them to the Scranton people. The president of the Scranton company was firm in refusing to break the trust price, and Mr. Sloan applied to President Gates, of the Illinois Steel Company, who did not show so much firmness. President Gates went to Pittsburg and had an interview with President Frick, of the Carnegie Steel Works, and wanted to cut prices, but could not obtain permission to do so. On returning to Chicago, he called a meeting of the directors of the Illinois Steel Company, and they agreed to leave the business to the judgment of their president, and he then agreed to sell under the trust prices. The Carnegie people at once quoted lower prices than ever steel rails had been sold for, and the trust was dead.

Since the trust was formed, there have been great improvements effected in the steel-making business, and the cost has been greatly reduced where the most modern furnaces, machinery and processes have been introduced. Two or three of the steel makers have devoted part of their incomes to betterment of their plants, but others have done little or nothing to improve their facilities; consequently, there are several rolling mills which can sell rails at profit at a price which will ruin the others. Unless some new kind of arrangement can be fixed up, about three of the six remaining steel mills will close up as soon as the heavy demand for steel rails ceases and the era of competition returns. About 800,000 tons of rails have been contracted for under the cut prices, which is two-thirds of the entire output of last year.

WRECK THAT HAPPENED IN A TUNNEL. ENGINE AND CARS HAULED SIXTY MILES IN THIS CONDITION.

Double Button for Locomotive Headlight.

The double button for locomotive headlights, hereby shown, has been invented by Mr. W. W. Pitts, an engineer on the Missouri, Kansas & Texas Railway. The object of the invention is to prevent the smoking of chimneys and burning of the same.

When this button is once properly adjusted to the burner, the flame assumes the form of an egg, and seems to make the combustion so perfect that the flame can be out at the top of the chimney without causing any smoke.

DOUBLE BUTTON FOR HEADLIGHTS.

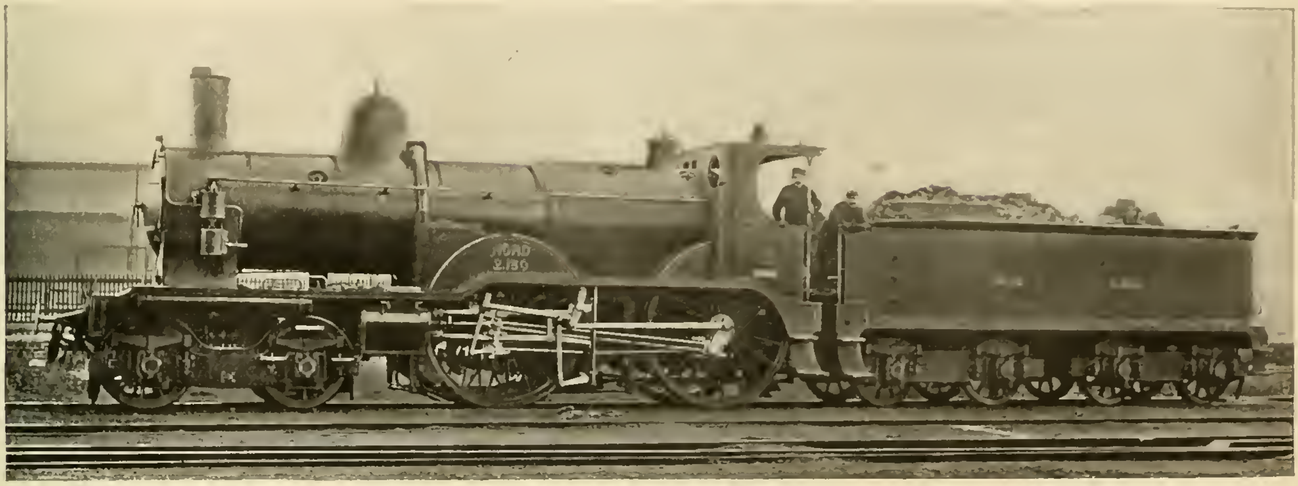
Those who have wrestled with the adjusting of a locomotive headlight on a stormy night will appreciate the advantage that this button gives, since it makes adjustment so easy and does away with the nuisance of smoky chimneys. The inventor is making the button for sale, and it is in use on the headlights of a great many locomotives in the Southwest, and is highly popular with the engineers.

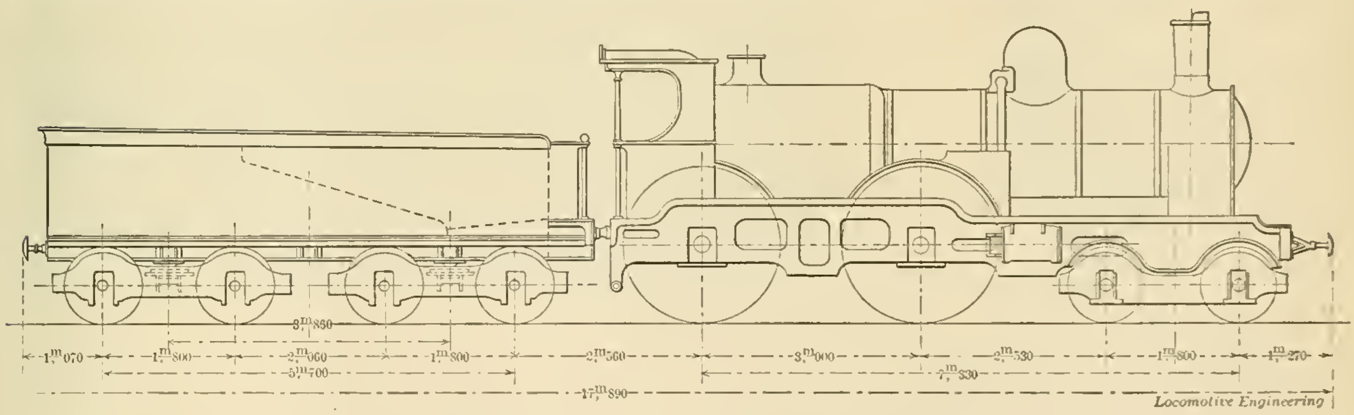
The management of the Baltimore & Ohio Southwestern have established a bureau of development, whose duty it is to interest manufacturers in the towns along the railroad, and try to get them to settle in some of the towns which will give business to the company.

New Compound Express Engines—North of France Railway.

We illustrate herewith a new type of compound locomotive for express service on the Northern of France Railway ("Chemin de fer du Nord"), and built by the Société Alsacienne de Constructions Mécaniques.

The success of the original compounds, Nos. 2121-2122, has been such that the main features of the design have been adhered to in each succeeding class that has since appeared, the boiler power alone having been progressively increased. Thus, with cylinders of precisely the same dimensions, the grate area has been increased by 2.8 square feet, the firebox heating surfaces by 5.1 square feet, and the tube heating surfaces by 702 square feet. The tubes remain the same length —12 feet 9 inches—as before; but, by raising the axis of the boiler, larger barrels are permissible, as well as deeper fireboxes. In these new engines the boiler center is raised to 7 feet 11 inches, and the inside diameter of the smallest ring next smoke-box is increased to 51¾ inches. The boiler pressure is now 201½ pounds, instead of 182 pounds, and the maximum tractive effort has been consequently raised to 7.9 tons, or, with boiler steam direct to the low-pressure cylinders, 10.3 tons.





NORTHERN RAILWAY OF FRANCE COMPOUND.

Notwithstanding this increase of boiler capacity, which contributes so largely to the splendid steaming qualities of these engines on long, rising gradients, the dead weight of the engine, empty, has only been augmented by 2.3 tons; and on this score, these Northern engines still remain remarkably light, relatively to their maximum power.

For long-distance runs, a more extended smokebox has been advantageously introduced, its inside measurements being 3 feet 2½ inches long by 4 feet 7½ inches diameter, while a deeply concaved door has still further added to its effective capacity.

Another alteration of detail is in the dome, now placed on the middle ring, farther from the firebox, and in front of the apparently unavoidable outside dry pipe of Continental practice, which is, thus, in some way sheltered behind the dome casing.

The chimney is fitted with a shield for facilitating the ascent of smoke when the regulator has been closed.

The tender, now, for the first time in France, carried upon two four-wheel bogie trucks, is of more elegant design, and lower by about 7 inches, than the six-wheel tenders. An increased capacity for water of 234 gallons, and for coal of 1 ton, permits runs of 95 miles with average loads, without necessity for taking water.

Although the new engines have only been in service for a few months, and therefore still under trial, the results appear to be highly satisfactory, and reflect to the initiative ability of M. du Bousquet, for maintaining his motive power upon a level with the most approved practice of the day. On curves, the movement of the tender is said to be remarkably easy, and it is very probable that this class, 2158-2160, will be repeated in the subsequent orders placed by the Northern Railway.

New Compound Engines, Class 2158-2160.

Grate area—24.7 square feet.

Heating surfaces, fireboxes—122 square feet.

Heating surfaces, tubes—1,767 square feet.

Heating surfaces, total—1,889 square feet.

BOILER.

Inside diameter of smallest ring—4 feet 3¾ inches.

Smokebox, inside diameter—4 feet 7½ inches.

Tubes, length between plates—12 feet 9 inches.

Center from rail—7 feet 11 inches.
Pressure—201½ pounds.
Cylinders, high-pressure—13½ inches.
Cylinders, low-pressure—21 inches.
Piston stroke—25¼ inches.
Wheels, driver (coupled), diameter—6 feet 11 inches.
Wheels, bogie—3 feet 5 inches.
Centers, bogie axles—5 feet 11 inches.
Centers, bogie axles to drivers—8 feet 4 inches.
Centers, driving axles—9 feet 10 inches.
Centers, total wheelbase—24 feet 1 inch.
Weight of engine, empty—45.4 tons.
Weight of engine, loaded—49.5 tons.
Weight under driving tires—30.5 tons.
Maximum tractive effort (theoretical), working compound—7.9 tons.

TENDER.

Total length of frame—24 feet 2 inches.
Total length of frame over buffers—26 feet.
Height to top of tender (loaded)—8 feet 8 inches.
Bogie pins, center to center—12 feet 7½ inches.
Centers, rear driver to first bogie pin—8 feet 4½ inches.
Centers, bogie axles—5 feet 11 inches.
Centers, between nearest axles of each truck—6 feet 10 inches.
Total wheelbase—18 feet 8 inches.
Total length of engine and tender over buffers— 58 feet 7 inches.
Weight of tender, empty—19.5 tons.
Capacity, coal—5 tons.
Capacity, water—3,520 gallons.
Weight of tender, loaded—40.3 tons.
Weight of engine in working order—89.8 tons.

Tonnage Rating of Locomotives.

Some time ago the Western Railway Club appointed a committee to investigate recent developments in the tonnage system of rating locomotive performance. Report was made at the December meeting of the club. It said:

"The developments in the tonnage system of rating locomotives, as far as your committee has been able to carry its investigation, consist principally of three parts or divisions. First—In efforts to improve the accuracy of the way-bill weights and light weights marked on cars, which are used to ascertain the weights of trains as made up. Second—To make proper allowances in the ratings when trains consist wholly or in part of empty or partially loaded cars. Third—To so arrange the performance sheet that proper deductions may be made from the results shown thereon. Much yet remains to be done in these three directions, and it is the intention of your committee to offer, as suggestions for discussion and further investigation, the following topics, which, in its opinion, have a direct bearing on the question.

"Under the first division, the following topics are of importance:

"(*a*) The actual weight of the contents of the car should always appear on the way-bill. Agents often bill unweighed bulk freight at minimum carload weights, almost regardless of the actual weight of the contents. Where actual weights cannot be obtained, agents should be trained to estimate them as closely as possible. Present practice results in general overrating.

"(*b*) Actual weights of empties containing tare of various kinds should be used. Empty stock, refrigerator or other cars often contain large amounts of refuse matter, ice and other substances, which make them, in fact, partially loaded cars. Systematic methods of treating such cars as partially loaded should be worked out. The tare in these cars will vary on different divisions of the same road, and often on the same division.

"(*c*) The weight of the engine and tender should be included in the weight of the train. The engine and tender must be moved as well as the cars, and as they vary greatly in weight, their weights should be included in the rating. Where coal premiums are given, allowances should be made for the varying proportion of coal consumed in moving the engine and tender, when hauling trains of different weights below their full rating.

"Under the second division, the methods to be employed to improve existing conditions must be more experimental than administrative. We may improve the accuracy of our loading and estimating the weights of trains, by proper instructions and administrative methods; but we cannot tell the relative effect upon the performance of the engine, of a given tonnage in heavily loaded cars, and the same tonnage in empty cars, without actual tests. Tests should be made of trains of loaded, partially loaded and empty cars, of known tonnage, on different gradients and with different conditions of curvature; such tests, to cover even ordinary conditions, must be made with a dynamometer. They must be numerous and very exhaustive, and when finished they may show so many variable factors necessary as to make their practical value small. Every train that is run can be made a means of giving valuable information on the proper rating of empty and partially loaded cars, provided a careful record of its make-up, and the resulting performance, is kept and compared with other trains of different make-up, hauled by the same engine and crew. Close attention must be given to weather conditions, especially the wind, in making comparisons.

"Under the third division, the economic results to be obtained by the stimulus upon the enginemen, of a well-arranged locomotive performance sheet, are unquestionable. How can the actual performance of locomotives be best expressed on the performance sheet, and the relative efficiency of different men, as well as different kinds of motive power, shown? The coal consumed per ton-mile is generally recognized as the most accurate and best basis of comparison. This may be shown either in pounds of coal per 100, 1,000, or some other unit of ton-miles; or, and preferably for the improvement of the men, in dollars and cents cost for fuel per some convenient ton-mile unit. As the pounds of coal are more valuable as a basis of engine comparison, both methods should be used. Grouping all enginemen who are in exactly comparable service, together upon the performance sheet, is important. It is manifestly unfair to compare men in dissimilar service, and it should be understood that only those grouped together can be compared. The weight of the average train hauled during each month, by each crew, should be shown. The average speed is important, but practically impossible to obtain, especially in freight service. It need not be shown. Different types, weights and designs of locomotives give different results on the same division. The tonnage rating, together with a properly arranged performance sheet, should enable the most efficient design to be selected for each division. Here especially, but of course in all other phases of this important question also, the hearty and intelligent co-operation of the operating and mechanical departments is of the greatest importance."

Somewhat Fishy.

We have published several anecdotes lately concerning matters on the Delaware, Lackawanna & Western, but a correspondent, located on the Western part of that great railroad, sends in a story that is liable to put considerable strain upon the credulity of the readers.

He says that when the "Queen City Special" was making its way toward Buffalo, the engine being in charge of John Evans, who is generally regarded as a truthful man, the injector suddenly stopped working, and the engine was stopped, that the cause of the trouble might be ascertained. On taking down the hose between the engine and tender, a large eel wiggled out and began making its way over the ice. The engineer despatched the eel with a monkey wrench, and carried it to the end of the division, to put forward as a testimony of why time was lost on an important express.

The eel was 14 inches long, but our correspondent does not give the dimensions as to its thickness. Any of our readers who wish to have full particulars regarding this eel story, should apply to Mr. T. H. Gonware, 1107 Lake street, Elmira, N. Y., or to Engineer Evans.

Cheap Air Hoists.

Mr. D. J. Justice, general foreman of the W. C. & A. Railroad shops at Florence, S. C., writes us:

I have noticed with much interest the various appliances for labor-saving, especially the application of compressed air in lifts, etc., which have appeared in your most excellent journal from time to time; and as we have gone more or less extensively into using it in our shops here, within the past year or so, we find its use not only very satisfactory, but now almost indispensable in such work as cleaning out boiler tubes in locomotives, driving rotary drills, valve-seat planers, cylinder boring-bars; furnishing blasts for portable forges, and power for hoists. As I have recently erected two large home-made air hoists, I take the liberty of sending you a description of them and photograph of the first (for which I am indebted to one of my enginemen, who is almost as handy taking snap-shots as he is handling one of the Baldwin 19 x 24 trailers with the famous "A. C. L. Florida Special Vestibule Train"), which you may publish, if you see fit, as my contribution to the current air-hoist literature.

The view shows the hoist in the act of lifting an engine truck center casting. As will be noted, the cylinder of the hoist is bolted to one of the pillars, and pulls down on the chain; it is made of seven 10 x 14-inch coach-brake cylinders, which had been discarded on account of broken flanges. These cylinders are arranged in line, and held together by rods, with nuts on each end.

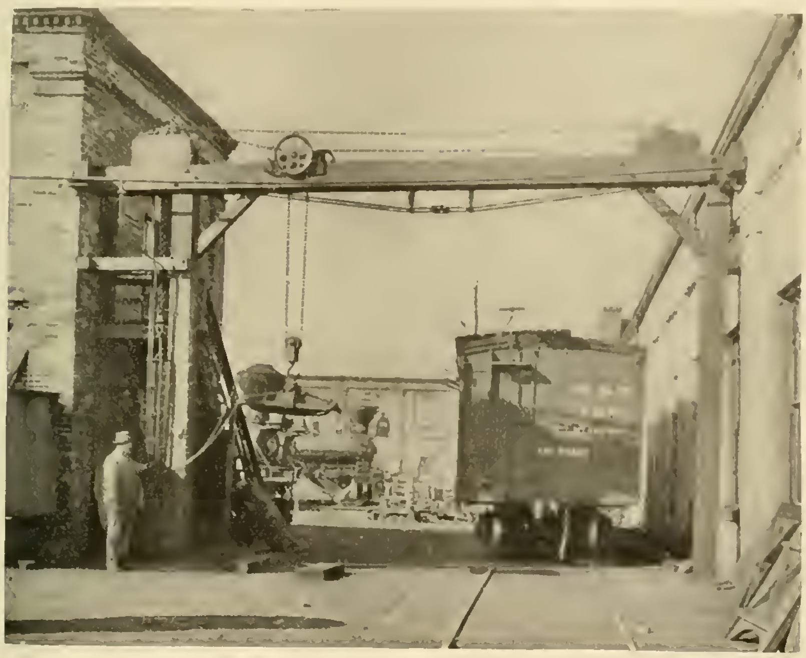
As you will see, this makes a cheap, convenient and powerful hoist, with about 8 feet lift, and is an example of what can be done with old material, with the exercise of some thought and ingenuity.

In operation, air is admitted to each end of cylinder, admission and discharge being controlled by a four-way cock, giving a very prompt and accurate movement.

This hoist is located between machine shop and store room. The second is erected in the wheel-press room, in rear of machine shop; has a cylinder made of three of the 10 x 14-inch brake cylinders, similarly fastened together. This cylinder swings from a trolley, which runs on two 8-inch I-beams which travel on tracks at each end, which gives it movement in all directions, controlled at will by hand-chains. Air is controlled in this cylinder also by a four-way cock.

These hoists work very satisfactorily; were erected at small cost, as principally old material was used; and they are much admired.

For the benefit of any wishing to make use of such cylinders for this purpose, I will state that it is necessary to recess or counterbore, male and female, the joints at ends of each cylinder, to keep them in proper alignment.



CHEAP AIR HOIST.

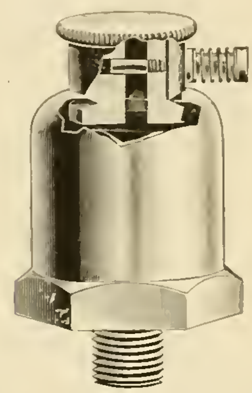
Combination Planer and Grinder.

It is not uncommon to find an old planer utilized as a surface grinder after having outlived its usefulness as a planer, but it is quite unusual to see a planer that will do good work in either capacity. There is one fitted up at the Huntington, W. Va., shops, to true up the worn sides of hardened links, and at the same time reduce the block in width, a proper amount to have the correct play between flanges.

In grinding links to take up lost motion due to block wear, a surface plate, to which is secured the link and block, is bolted to the planer platen. The plate has a depressed surface on its face to receive the block; the depression or groove being of such a depth that the bottom of the block stands below the bottom of the link about a thickness of thin paper, or an amount which will leave the block sufficiently thicker than the link to give a proper play between flanges. The machine is speeded up with two ranges of platen speeds, so as to satisfy all conditions of grinding and planing. All grinding attachments are quickly applied or removed, which makes the machine a very useful tool to the link gang.

The Enggren Oil Cup.

The oil cup shown in annexed engraving has several good points that are entirely its own. In the first place, the top is quite securely fastened, so that it cannot possibly shake off, and yet it is fastened in a shape that any man can take off without the use of a wrench. The using of wrenches on oil cups is a bad thing, for men in a hurry often fail to discriminate on the extent of the twist to be given, and consequently many cups are wrenched off by accident.



ENGGREN OIL CUP.

Another good point about the cup is that the adjusting can be done with the fingers without any difficulty. A man can reach through the drivers, take the top of this cup off and adjust the feed without taking his gloves off. It appears to us that the cup will be found a great convenience.

It was patented by Mr. E. L. Enggren, Ozone Park, N. Y., and is for sale by the patentee.

Illinois has a greater number of miles of railroad than any other State—10,509.59. Pennsylvania is second, with 9,666 miles; Texas third, with 9,222.88 miles. Rhode Island has the least mileage—321.05. New York has 8,078 miles; Ohio, 8,500.23; Indiana, 6,295.28.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

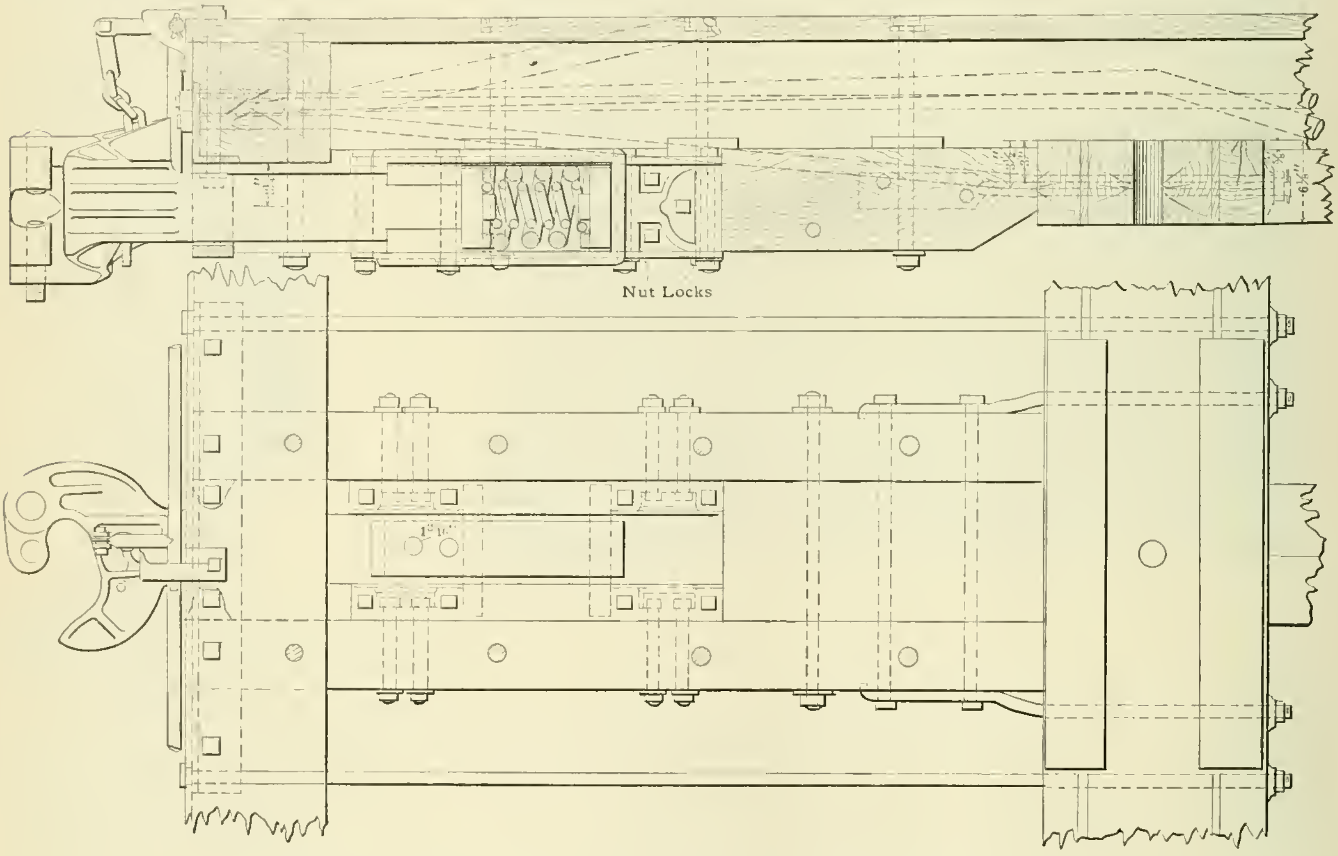
Standard Twin Hopper Gondola Car—New York Central & Hudson River Railroad.

The New York Central coal car herewith illustrated will bear the closest scrutiny of those interested in good practice in car construction, for the reason that it is of to-day and represents what is considered the proper thing for the coal traffic of one of the most important systems of this country. It is of the double hopper type, and has many strong points in its make-up that will commend themselves to all who are familiar with the difficulties attending the attainment of proper strength in a car body having twin hoppers, whose construction involves the sacrifice of material in places where it is most needed.

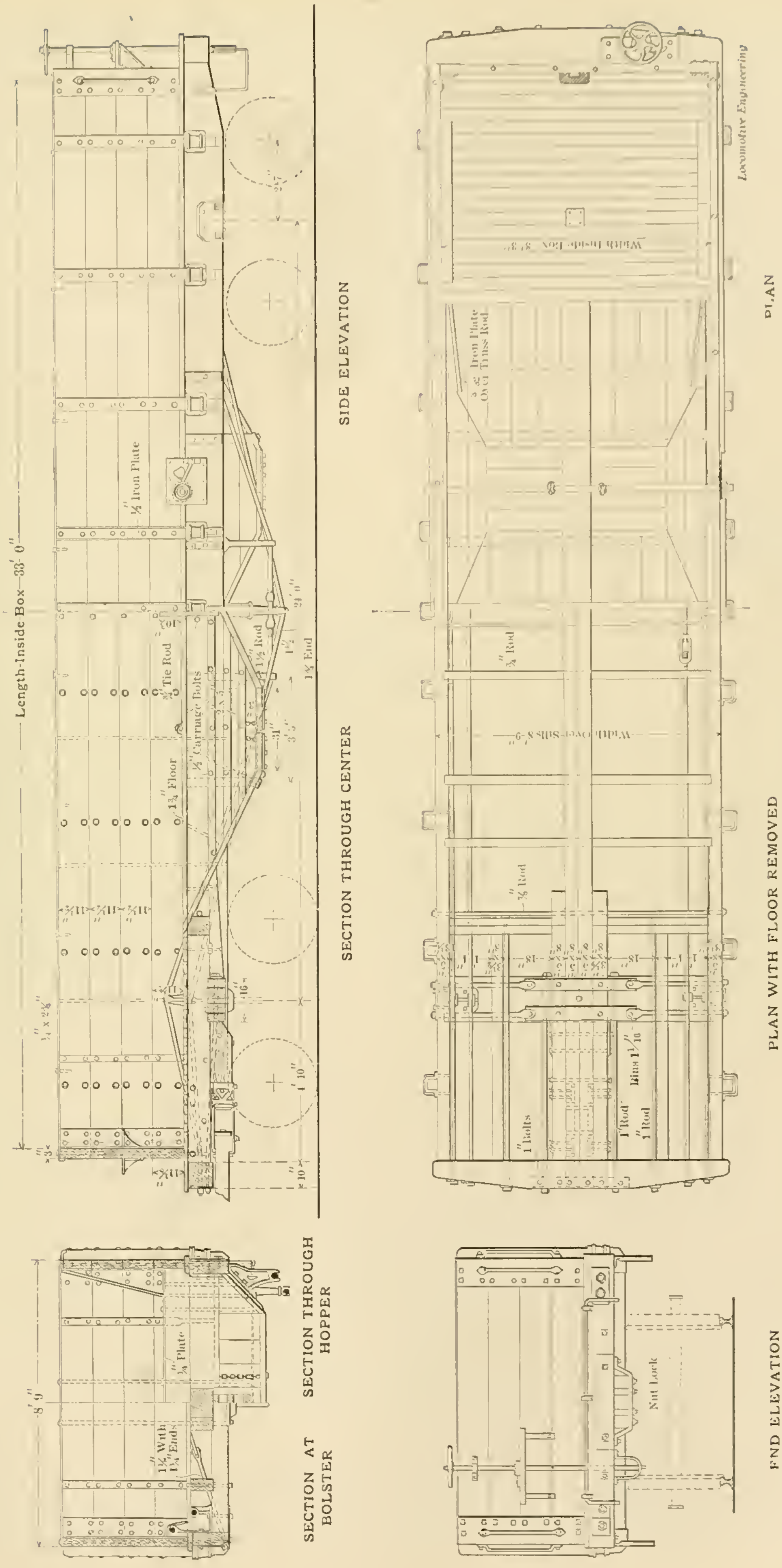
In general dimensions the car does not depart greatly from existing figures for its kind, it being 35 feet 4 inches long over end sills, and 8 feet 9 inches wide over side sills. The center sill is formed of two 5 x 8-inch pieces extending the length of the car, making a stiff center member, and this is reinforced by two 5 x 8-inch pieces for a distance of 8 feet from each end sill. The outside sills are 5 x 13½ inches, and the end sills are 9 inches thick by 10 inches wide for a distance of 38 inches at the center, to receive an angle iron 3½ x 6 x 35⅜ inches, whose function is solely to take the shocks from the drawbar buffing lug. The ends are beveled on the outer face from the angle iron to the ends, leaving the latter 8 x 9 inches on the face, the corners of which are rounded off. Into the center sill reinforce timbers there are tenoned two header blocks 6 x 8 inches, 6 feet 10½ inches from the inside face of the end sill, and these are mortised to receive the two intermediate sills. These headers are firmly secured to place by a ⅞-inch rod with washers and nuts, on the outside faces of side sills, and they are further tied (longitudinally) by a 1-inch rod through the end sill.

At the center of the car, between the points just noted, the construction is, of necessity, somewhat weaker, on account of the hoppers, but recourse is had to a system of trussing that compensates for the loss of material of the usual kind in the form of intermediate sills. There are four truss rods 1½ inches diameter, with ends enlarged to 1¾ inches. Two of these, the outside pair, have a drop of 30 inches at the center, and are supported on two posts, while the inside pair have a truss of 44 inches, and each is supported by one post on the 5 x 10-inch center cross-tie timber. This liberal trussing will show results on the right side of the ledger after these cars have seen a few years of service.

What looks like an efficacious scheme for the prevention of bulge at the sides of the box, is seen in the end sectional views. There is a ⅞-inch rod at each center stake, passing down through the cross-tie timber; the top end of the rod having a ⅜ x 2-inch flat end, which hooks over the top of the stake. The rod is backed by an oak block having a base 10 inches wide and tapering to a point at the top. The hoppers are lined with ¼-inch plate and are well secured by 1 x 3-inch carry irons. The sides are covered at the top with ¼ x 2¾-inch iron, well secured with ⅝-inch lag screws, and ¾-inch bolts through sideboards and outside sills. A detail that is specially prominent as a good thing is the steel corner plate, continuous from flooring to top of coal sides, both inside and outside; there is rigidity and strength in such plates, and if there



DRAFT ATTACHMENTS OF NEW YORK CENTRAL HOPPER GONDOLA CAR.



NEW YORK CENTRAL HOPPER GONDOLA CAR.

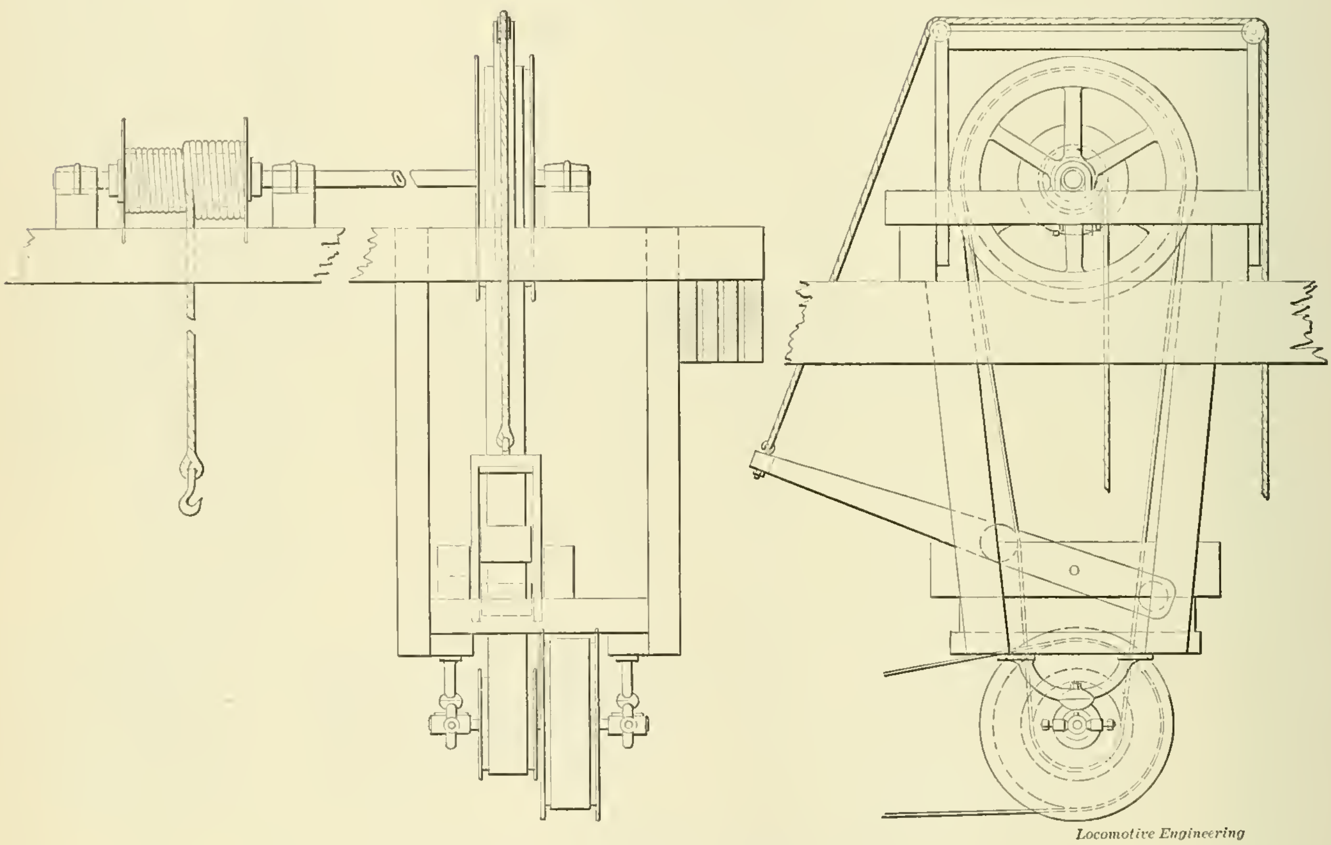
is any place where those conditions are required, it is at the corners. They are certainly an improvement over the sectional variety of corner plate.

The composite body bolster with truss rods has stood up under the most exacting conditions on this road, and is not now deserted for its metallic congener, as will be noted in the engravings. A good solid construction is shown in the details of the draw-gear, in which great attention has apparently been given to put this part of the car into an invulnerable shape. The draft timbers are 6 inches thick, and extend back to the body bolster, furnishing a massive foundation for the draft lugs, which are also assisted in resisting buffing strains by their bearing against a heavy block which fills the space between draft timbers, and also extend back to the bolsters; three transverse bolts, ⅞ inch in diameter, bind the timbers and block firmly as one piece. The draft timbers are under strain against the bolster by means of two 1-inch bolts, which pass through the bolster, with nuts at back, and engage with the former with a strap body having a lug turned over at the end; two of the transverse bolts pass through these straps, thus providing for trouble in either direction.

The coal space is 33 feet long, 8 feet 3 inches wide, and 3 feet 10 inches high, giving, with the hoppers, a capacity of 1,220 cubic feet. With coal at 50 pounds per cubic foot, the load would be 61,000 pounds. We are indebted to Mr. Wm. Buchanan, superintendent of motive power and rolling stock, for the prints from which our engravings were made.

A Home-Made Hoist.

One of the handiest inexpensive arrangements for hoisting cabs, pilots, headlights and other impedimenta out of the way to an elevated platform, and coach seats and trimmings to the upholstering department, is shown in accompanying engraving. It is only a combination of pulleys, but an effective one. A tight pulley with a slack belt drives another pulley on the same shaft, with a drum, on which is wound an ample length of rope.



STEWART'S HOME-MADE HOIST.

The slack belt referred to is made to tighten on the driving pulley by means of a pivoted lever in the control of the operator by another rope within comfortable reach. Any pull on this rope starts the machine in motion, and as the load lifted depends on the degree of tautness of the belt on the driving pulley, the lift is easily within the control of the man handling the tightener. When seen in operation, this lift looked like an efficient device for the money there was in it. It is one of Master Mechanic Stewart's schemes at Huntington, W. Va.

An improvement on his well-known sanding apparatus has been patented by Mr. Henry L. Leach, of Cambridge, Mass.

Extensive Use of Compressed Air on the Chesapeake & Ohio.

The wide range of uses to which compressed air has been put in the past few years cannot be better exemplified than by citing a few of them as found in a West Virginia shop at Huntington, just an ordinary well-appointed railroad shop, but one where the master mechanic is not willing to take long routes to reach a result while a short cut is in the line of his vision.

Like a great many other shops, this has had its experience in compressing air with air pumps, and found the drain on the boiler such as to preclude their use, except in such a restricted way as to practically shut out anything like an extensive application of the new power for labor-saving appliances; but, unlike many more shops, this has had the good fortune to obtain a two-stage Norwalk compressor, 9 x 16 inches, with an accumulating cylinder 14 x 16 inches. This compressor has taken the place of nine 8-inch air pumps, and does its work on about 33 per cent. of the steam consumption formerly required for the nine pumps. This looks like a good place for somebody to stick a pin for reference, when the subject of compressors for shop use is up for discussion.

All boilers are put under a test pressure by air, 25 per cent. greater than the rated boiler pressure, by means of a 6-inch pump having its air cylinder bushed down to 2½ inches diameter for exclusive use in boiler testing. When applying the test pressure, the pump is connected to the engine by piping to the blower pipe at the smoke arch and taking the pressure through the blower valve in the cab. The pressure is nicely sustained by the pump governor. The air used for the test is then utilized for blowing out the cylinders, leaving everything clean and dry about the engine in beautiful contrast to the wet process.

Boilers are run out of the erecting shop under air at 110 pounds pressure, let in on one gage of water at a temperature of 212 degrees; this pressure and volume being sufficient to take the engine to the transfer table and off on the test track, preparatory to coupling up the tender.

Air hoists, now so much in evidence in all shops making any pretensions to the use of air, are in extensive use here, and seen at their best. There are twenty of these useful tools in the machine shop, two of which, located at the driving-wheel lathe and wheel press, are 12 inches in diameter by 5 feet lift. The others are 4 and 6 inches diameter by 6 feet lift. In the car shop there are also two of 12 inches diameter by 9 feet lift, for raising or transferring a six-wheeled passenger truck. All these lifts are run on trolleys, and are capable of movement in any direction. The brass foundry is also equipped with traveling lifts, to handle the molten yellow stuff; in fact, there are few places about the shops, in which air can be used to advantage, that it is not speedily harnessed; all of which is made possible by the compressor.

A Glass-Etching Device.

Devices for doing work with compressed air are brought to a state bordering closely on perfection at the Huntington paint shop; in fact, it may be said that there are few kinks with air that are unknown in that shop, as it is the policy to do everything possible by means of that useful agent.

In glass ornamentation with air and sand, silver foil is used largely in transferring figures to the glass. The foil is first placed on the plain glass; a perforated pattern is then laid on the foil, and the latter is trimmed with a knife to the lines of the desired ornamentation. A coat of paraffine is then placed on the trimmed surface, and also on the silver foil; after which a second trimming is necessary to remove the paraffine outside of the pattern; this operation then leaves the glass bare outside of the required figures. The glass is then ready for the sandblast, and is placed in a box 6 feet long, 3 feet high and 18 inches wide, which constitutes a part of the permanent sandblast outfit. The engraving shows one of the handiest and most complete arrangements of what is now a very well-known process in glass ornamentation by abrasives. It is seen to be a permanent rig, made up of a 12 x 33-inch air-brake auxiliary turned into a tank for holding the sand supply, and properly piped for air and a nozzle, all of which the engraving explains to those who have a desire to improve on a makeshift outfit. The nozzle is 3/8-inch diameter and the air pressure ranges from 80 to 100 pounds per square inch.

Scrap Credits.

The Arbitration Committee of the Master Car Builders' Association held a meeting on December 16, 1896, and made the following rulings:

"H.—When scrap credits are allowable, the weights credited should always be equal to the weights of the new metal applied, except as otherwise provided in the Rules and in Section D of Leaflet No. 1, September 16, 1896.

"I.—Several inquiries as to the meaning of the words 'switching roads,' in Section 25 of Rule 5, were considered, and the committee makes the following ruling as a definition of a switching road as used in this connection:

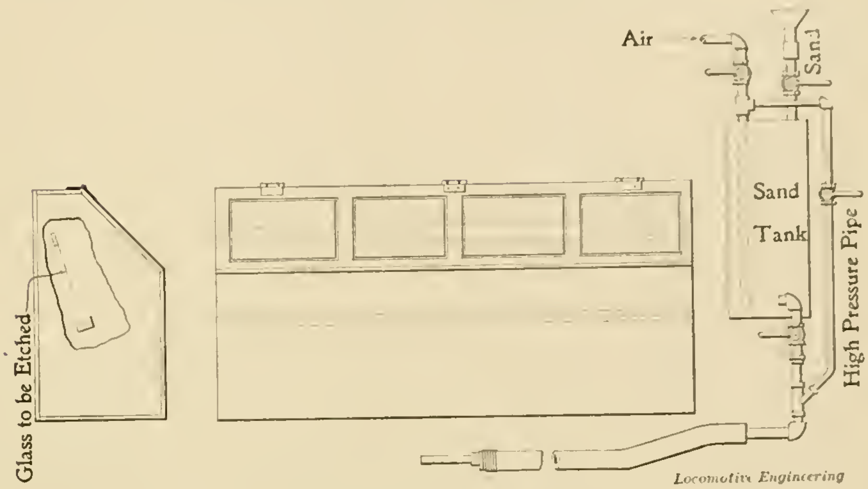
"A switching road is a corporation doing the major part of its business on a switching charge, or one which does not pay mileage to car owners for the use of the owner's car."

Malleable Iron in Freight Cars.

The importance of malleable iron as a factor in holding down the dead weight of cars, is well exemplified in the case of the 65,000-pound coal car illustrated in the February issue. With this car are shown two examples of light malleable castings, usually made of gray iron.

Superintendent of Motive Power Turner writes, since the description of the above cars was put in type, that he has decreased the weight 1,800 pounds less than when cast iron was used in their construction, bringing the light-weight down to 29,200 pounds, which will be acknowledged very low for a 65,000-pound car.

That this has been done without a sacrifice of strength, is amply proven by performance in a coal service where no quarter is given, as the cars are frequently loaded all the way from 70,000 to 72,000 pounds, and will average 68,000 pounds to the load with no evidence of weakness.



GLASS ETCHING DEVICE.

How to Suppress Train-Robbing.

If legislators and juries would take inspiration from Governor Stone, of Missouri, in trying to suppress the crime of train-robbing, the industry would be stamped out as effectually as similar crimes were suppressed in Mexico by the vigorous action of President Diaz. In a letter written on the subject of train robbers, Governor Stone said:

"During the last two or three years several train robberies have occurred in this State. They have also occurred frequently in other States. In almost every instance, those committing these crimes in Missouri have been apprehended and punished by imprisonment. In 1895 a law was enacted by the Legislature of this State, making train robbing a capital offense. I heartily indorsed the enactment of this law. Train-robbing is a crime which greatly endangers human life, as it is accompanied by circumstances of risk and danger, and is perpetrated by armed and desperate men. It is usually accompanied by actual violence done those in charge of the trains and express cars. But, in addition to the foregoing, it is a crime which brings a State into public disrepute to an extent greater than any other crime in the calendar of which I have knowledge. Its frequent occurrence will do incalculable harm to the State. It is a crime that should be broken up, and I confess disappointment and impatience that juries do not deal with criminals of this class with the utmost severity. The execution of a few highwaymen, a punishment always richly deserved, would, in my judgment, put an end to this description of crime in this State."

Practical Letters from Practical Men.

Two Kinds of Engineers.

(A Sequel to "Two Kinds of Firemen.")

THE POOR ENGINEER.

Editors:

Some men would never make good economical engineers if they would run an engine all their lives. A poor engineer will couple onto a train, and if he is late he will try to make all the time up the first ten miles out. The fireman will get a "slug" in her, and the engineer will pound a fresh fire to pieces and ruin it for economical steam-making in the beginning of the run.

Some men, if they are late, will make up their time and then lose it again oiling around at the next stopping-place. Some men will leave the starting-point of a run on time, with a reasonably fast time to make, and will run as fast as they can part way to the next town, and, finding they are going to arrive too soon, shut off and let the train roll into the next town. The same process is repeated at each succeeding station throughout the run. In the meantime, the fireman gets in a good fire at each station, determined to keep her hot or burn all the coal in the tank, and when the engineer shuts off to let her roll into the next town, the safety valve will scream with joy.

Another kind of poor engineer is a man who may not be a hard hitter, but who will let his balance packing blow, or his steam pipes or nozzle leak, or his diaphragm be poorly adjusted or loose; and if the fireman ventures to hint that he thinks so-and-so is the matter with the engine, he will at once become alarmed about showing his ignorance, and gravely inform the fireman that he is "firing her too heavy," or "not firing her level." He may, to cover up his ignorance, tell him he is "not paid for running the engine," or he may say: "You know too much." Such a man will be afraid to report anything, because he don't know for sure what to report.

Some engineers have no confidence in the engine's ability or their own, on a hill, and want the engine popping all the time, as they say they can't "pull cars on cold water." Some men go over a hill like a man running a mile to jump over a three-board fence. He is out of wind and weak when he gets to the fence, and can't jump. Some men will do half of their work and neglect the other half, in order to do half the fireman's work, watching the stack and steam gage and each shovelful of coal that the fireman puts in, in the meantime forgetting to hook her up or shut off his injector. A master mechanic can look over a roundhouse work-book and pick out the intelligent engineer by his reports.

Some engineers will be noted for having a good-running engine and a good steamer, while another will be noted for having a poor engine and a poor steamer. Some men will make the statement that the vent hole in the top of a balanced slide valve is to let oil into the valve and cylinder, or to set out the packing with steam; or that the overflow of a Monitor injector is leaking, when it will be the primer valve; or as soon as you apply the air brake, the retaining valve keeps the brake set; or will report on the roundhouse work-book that the driver-brake triple releases as fast as it is applied, or brakes apply themselves while running, or that tank brake does not set. Again, they will make the statement that there are no engines built with one pair of drivers; it would be impossible to run them; or that there are no cast-steel driving-wheel centers. If a statement is made that a steamship is run without valve oil, or any oil, in her valves and cylinders, he will sneer at such an idea, and on being quoted "Locomotive Engineering" for authority, will swell up with his five or ten years' experience, and say he has taken "Locomotive Engineering" for several years, and has Westinghouse's book, and never saw such statements. So many men will scan a mechanical book or paper the same as a child would scan a picture book, skipping over a hard, knotty problem, and reading a whole book in one hour. Such men would be hard to fire for, because they do not take enough interest in the machine they operate to find out the principles of its construction. One-half the credit for a good coal record is traceable to the interest and intelligence an engineer takes in the performance of his duty. If the engineer does not take interest, the fireman will be compelled to accept circumstances as they are, and probably will be unjustly blamed for the engineer's shortcomings.

THE GOOD ENGINEER.

The good engineer is the one who can do the work with the least amount of steam passing through the cylinder, and has confidence in his ability to contend with difficulties. He always does the right thing at the right time; no hurry, no fuss; everything goes along smoothly. A good engineer is not afraid to get down and take the scoop for miles, in order to "see how she steams." But in these days of extension fronts, large nozzles and brick arches (of which numbers do not understand the principles), they are in a quandary; probably having been educated under the contracted nozzle, diamond-stack age, some do not study to keep up to date. The good engineer does not rail and condemn the Traveling Engineers' Association or its form of examinations, or statements made by Westinghouse that an air brake don't fail. (For my part, I fail to find a useless question in the 272 questions of the Standard Examinations.) He is not afraid to discuss a question with a fireman, and would rather have an intelligent fireman than an ignoramus. There are three things that go together to produce good results; First comes smooth, steady running; second, slick pumping; third, an engine well kept up; fourth, good light firing will follow as a natural result from a combination of the other three.

A. A. LINDLEY,
Iowa Central Railway.
Oskaloosa, Ia.

The First Belted Compressor.

Editors:

In connection with the cuts and descriptions of the new belt air compressors, in your January issue, I inclose herewith a blueprint showing the general plan and details of a belt air compressor which I have had in use for the last five years.

As it may be of interest to you, and possibly some of your readers, to know something more of the tool and its use, I will add that my first idea of a belt compressor originated in connection with a deep-well pump which I constructed and patented in 1886, a blueprint of which is also inclosed herewith. We have one of these pumps working in a well 2,000 feet deep, and 600 pounds air pressure will start the flow of water, and 450 pounds pressure will maintain it. With this pump we can get a pressure of 800 pounds to the square inch with about 70 pounds of steam pressure.

The belt compressor was built in 1891, and, as will be seen by referring to the drawings, is constructed in a cheap and simple manner. There are two vertical compressing cylinders 8 x 14 inches, completely water-jacketed, each single-acting, having two cranks set opposite each other on a shaft driven by two 6-inch belts over a 40-inch pulley. This pulley also acts as a balance wheel, its weight being about 3,600 pounds. The compressor is entirely automatic in action, starting and stopping itself as the pressure rises or falls. This is accomplished by means of a small cylinder so arranged as to shift the belt when the desired pressure is attained.

This compressor has been in practical operation in our Houston shops for the last five years, furnishing air for hoists, jacks, small riveting machines, rivet cutters, and for moving dead engines in and out of the shops. In addition to this, we have our yard fully equipped with pipes, with suitable connections at all points where air is likely to be required for movable jacks and for testing air brakes on cars, which is a great convenience.

In the last two years we have built a number of these compressors, which are now in use in some of our division shops.

J. J. RYAN,
Supt. M. P.

Houston, Tex.

[The above letter from Mr. J. J. Ryan, superintendent of motive power of the Southern Pacific Railroad at Houston, Tex., conveys some information that may be more or less new to the users of belted air compressors. In this connection we will say that in May, 1892, one of the editors of this paper, Mr. John A. Hill, visited the Houston shops, and fully described this air compressor in the June issue of "Locomotive Engineering" of that year, together with the deep-well pump mentioned by Mr. Ryan. There is little doubt in our mind that this description of this belted compressor led to the building of all the belted compressors still made on the same lines.—Eds.]

Adjusting Eccentrics When Wheels Are Not Under the Engine.

Editors:

Given the main driving wheels of a locomotive standing on the shop floor, the old axle having been replaced by a new one, and required that the four eccentrics are to be set and keyed, so that they will have the correct angular advance according to lap and lead of value. This to be done before the wheels are placed under the engine.

The first thing to be determined is, whether the center of cylinder and crosshead pin is in line with the center of the axle. Fig. 1 shows that these centers are not in line; that is, that the center line *XX* of the cylinder and crosshead is not coincident with the center line *AA* of the axles, but above it. It also shows that the inclination of the main rod, when the crank pin is on its front center *DD*, deviates from its inclination when the crank pin is on its back center *EE*.

With the valve in its central position, in the steam chest *B*, and the upper and lower rocker pins an equal distance from the center *A'*, the lower arm is seen to be bent forward or have an offset, and it is also seen that the center line of motion *C* is on an incline. It will be necessary to take these three inclinations into consideration, namely, the two inclined positions of the main rod and the inclined position of the center line of motion. The next move is to find the amount of each inclination.

Take a pine board planed on one side and on lower edge, Fig. 2, and draw line *AA* to represent the center line of axles; after which, draw line *XX* parallel to it, and at a distance from it equal to the distance between lines *XX* and *AA*, in Fig. 1. The length of the main rod is then taken, to which is added 12 inches for the length of the crank arm, and a line

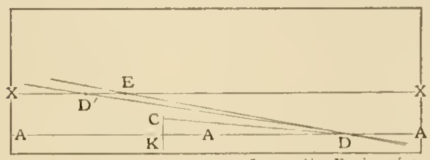


Fig. 2

ADJUSTING ECCENTRICS.

is drawn from center *D* to *D'*; also from center *D*, minus 12 inches of the length of main rod, to center *E*, these lines giving the inclination of the main rod for the front and back positions of the crank pin.

The radius of link, which is the distance from the center of the axle to the lower rocker pin center, when in its middle position, is next taken, and the arc *K* is drawn. The distance from the center line *A A* to center of lower rocker pin is next laid off, and the line drawn from *C* to *D* is the inclination of the center line of motion. Next, a square piece of wood is nailed under and parallel with each line, upon which is laid the degree spirit level *L*, by which to find the degree of inclination of each line, a memorandum of which is made for further use on the same class of engine.

The alligator plate *A*, Fig. 3, which has been described in "Locomotive Engineering" (page 973), and the level *L*, are applied to the wheel as shown; after which the wheel is rolled so that the alligator plate will be brought to the same inclination as line *DD*, Fig. 2. The valve is next measured and is found to have ¾ inch lap, and the lead is taken at 1-16 inch. The straight-edge *SS*, Fig. 4 (also described on page 973), is laid off, and as the rocker arms are of equal length, the distance *D C* is made 13-16 inch, which equals the lap and lead.

Straight-edge *SS* is placed in position with the level *L* on it, and the former is, by means of the wedge *K*, brought to the same degree of inclination as the center

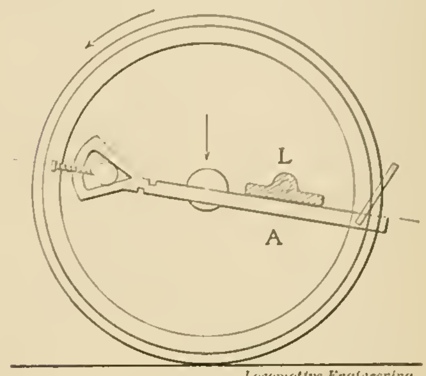


Fig. 3

ADJUSTING ECCENTRICS.

line of motion *D C*, Fig. 2. Bringing mark *B*, Fig. 4, in line with the outside of the axle, the square is moved in line with mark *D*, and moving the forward eccentric *F* so as to touch the square, it will be in its proper position. Moving the wheel on its back center like Fig. 5, and bringing mark *B*, Fig. 6, in line with outside of axle, the square is moved in line with mark *D*, and the backing eccentric *B'* is made to touch the square, bringing it into correct position. The other eccentrics are treated similarly, and when all are keyed to place the job is completed.

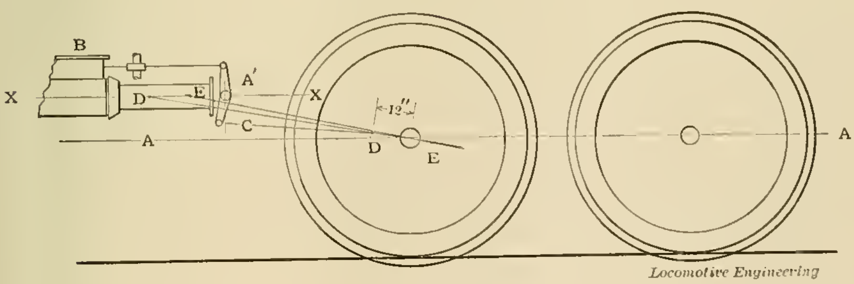


Fig. 1

ADJUSTING ECCENTRICS.

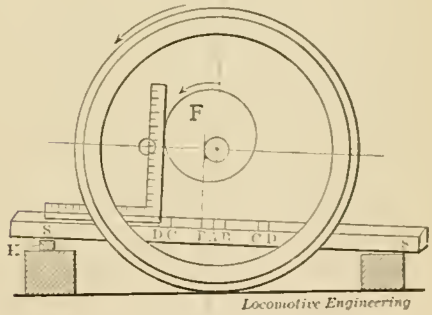


Fig. 4

ADJUSTING ECCENTRICS.

J. A. EISENAKER.

Elmira, N. Y.

Photographing Moving Trains.

Editors:

The exceedingly interesting article by Mr. F. W. Blauvelt, on photographing trains which are running at high speeds, was, without doubt, enjoyed by your large circle of readers. When one looks at the dial of a watch and sees the tiny divisions over which the second hand moves, and at the same time considers that the period of exposure which produced those excellent illustrations in your January issue only lasted the 130th part of a second, one is inclined to agree with Mr. Blauvelt that the surprising part of the operation is that enough light can pass in upon the sensitized photographic plate in a period of time so exceedingly minute.

There is, however, another consideration which brings before us how delicate must be the preparation now used in taking photographs. Professor Dolbear, in his work on "Matter, Ether and Motion," tells us, on page 158, that the silver solution used to-day can be affected by an exposure the 1000th part of a second in

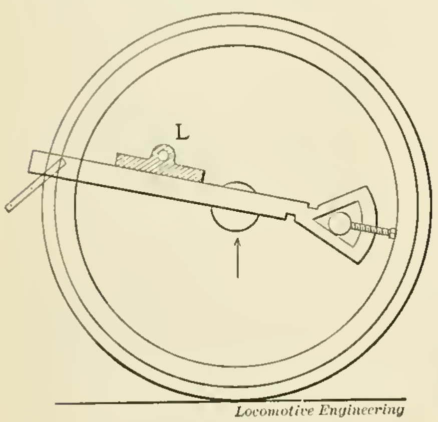


Fig. 5

ADJUSTING ECCENTRICS.

duration. Edison first used, in experimenting for the kinetoscope, an exposure of 2720th of a second, though the period of exposure has since been lengthened to very nearly that used by Mr. Blauvelt.

It is therefore not so wonderful that enough light can get into the camera in the prescribed time, as it is that, in this highly sensitive solution, the molecules of the silver salts can be dislocated and broken up with such incredible rapidity. The exposure of 130th of a second, during which the "Empire State Express," at full speed, was able to advance over 8 inches—most rapid as it certainly is—was yet slow enough to allow a ray of light 1,430 miles long to dash in upon the plate. If the ray of light had been a gossamer golden thread, stretching from Montreal to Winnipeg, its farthest end could have sped over half the continent, and the thread itself have been entirely reeled into the camera, in the time required for the shutter to spring across the face of the lens.

GEO. S. HODGINS.

Windsor, Ont.

Peculiar Wear of Valves.

Editors:

W. W. Pitts says that the wear is evidently caused by reverse lever not being let down in corner while running down hill. I am running an engine on a 25-mile hill; the lever is run in corner "down hill," and still the valves have this peculiar wear. This engine used to have the valve-stem rod extended to guide yoke, but now has solid-end valve rod. Would this not agree more with your explanation in January number?

W. WOODS.

Echo, Utah.

[It looks that way.—Eds.]

The Locomotive Balanced Slide Valve—Reminiscent.

Editors:

The so-called balanced slide valve, as used on locomotives, is not a balanced valve. It is a relieved valve; that is, a valve which is relieved of a very considerable part of the pressure forcing it

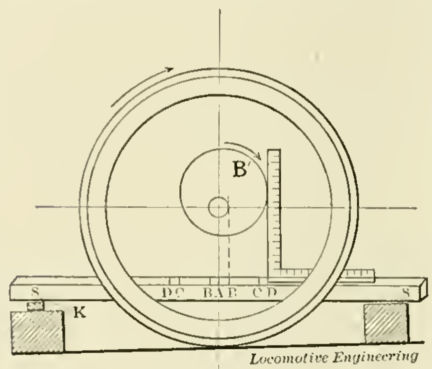


Fig. 6

ADJUSTING ECCENTRICS.

against the seat. While this relief permits the valve to be moved more easily, its motion consuming less power, if this saving of power was all there was to it, it would never be worth consideration. Moving more easily, there is less spring of the parts moving it, less wear of pins and other parts, and less wear of valve face and valve seat. All these parts will maintain their integrity longer, the result being a more satisfactory steam distribution and a saving from less leakage. But a balanced valve may be wasteful of steam quite as easily as saving.

I am led to this line of thought by the communication from S. J. Hungerford, with the title "Peculiar Wear of Valves," in January issue, and by happening to have been an actor in the making of the first (as well as several succeeding) slide valve for a locomotive that I ever saw balanced by four rectangular packing strips, inclosing a rectangular space top of the valve, from which space steam from the steam chest was excluded. The valve to which I refer was the invention of the late George W. Richardson, and the time nearly thirty years ago.

The rough sketch, Fig. 1, may be taken as a cross-section of this valve and seat. It will be seen that this was an open-top valve, the exhaust striking in full volume the plate *a*, against which the packing strips make a steam-tight joint. This proved a poor construction, although it was, in the main, like the original model that went to the Patent Office. There was too much opportunity for the sparks to interfere with the packing strips and grooves, which they did, to their rather speedy destruction. The first applications were to wood-burning locomotives, where the evil effects of the sparks

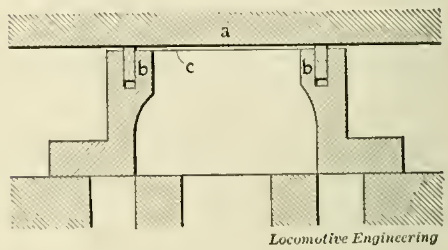


Fig. 1

BALANCED SLIDE VALVE.

were not particularly noticeable. But when the application was to a coal burner, this weakness developed without delay. Of course, when the engine was running regularly, the packing strips were held firmly against the plate *a*, Fig. 1, as well as against the inner surfaces of the grooves, as *b b b b*, Fig. 2; but when running shut off, sparks were pumped, so to speak, where they would do the most harm.

Richardson's next move was to practically destroy this spark trap by closing the top of the valve, as in Figs. 3 and 4, leaving a small hole in the top of the

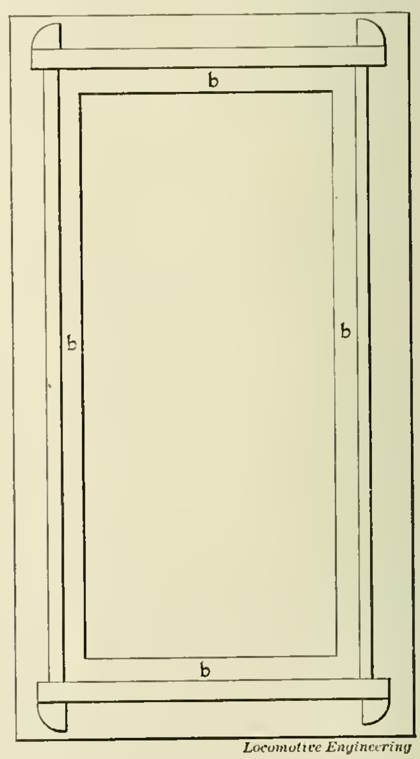


Fig. 2

BALANCED SLIDE VALVE.

arch to prevent the accumulation of pressure in the chamber inclosed by the packing strips, which pressure would, of course, destroy the balancing effect.

An inspection of Fig. 2, which is a top view of so much of the valve as is pertinent to the discussion, will make plain what Richardson's strong claim in regard to his balance packing was. That claim was, that each of the four packing strips was quite independent, in its operation, of either of the other strips. Each of the strips were for itself its own part of bearing against plate *a*, and its path of travel was never interfered with in the least by the travel of any other strip. This and the most natural manner in which the packing made steam-tight abutting joints, cannot be gainsaid. It appeals to the

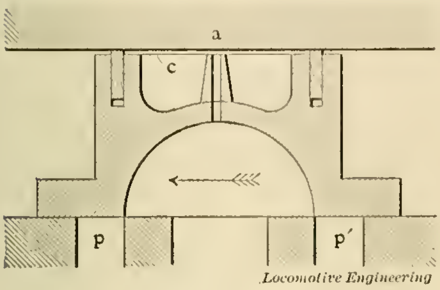


Fig. 3

BALANCED VALVE.

senses of the mechanic as nothing less than truth will appeal.

The necessity of close joints, as at *b*, Fig. 2, would have suggested to most mechanics a fine scraping of the contact surfaces. It suggested nothing of the kind to Richardson. Good planing was his entire reliance. Neither scraping nor filing was countenanced. A packing piece or a groove would plainly enough show the tool-marks due to the feed, which tell the mechanic plainer than long argument

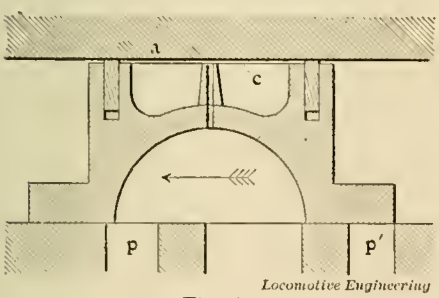


Fig. 4

BALANCED VALVE.

that the surface is a succession of ridges and depressions. These ridges and depressions are in the direction of the length of the packing strips and groove surfaces. The ridges are higher than the general surface. If the effort was made to surface these parts, they must first be removed. Richardson's argument was that a ridge—a line—bearing the full length of a packing strip would prevent leakage while the entire surfaces were coming, by slight wear, into intimate contact. As was rather common with him, he was right, I should think. It is evident that, from a slight springing of the parts from heat and pressure, the entire surfaces would not at once come fairly together, no matter how much pains were taken to that end. It would be poor design or workmanship, or both, that would not permit one line to come to a bearing very soon; one line, as the mechanic speaks of lines.

Richardson opposed the use of a milling machine for cutting the grooves for his packing, on the ground that the inevitable scoring due to the operation of the cutter, led in a semi-circular direction

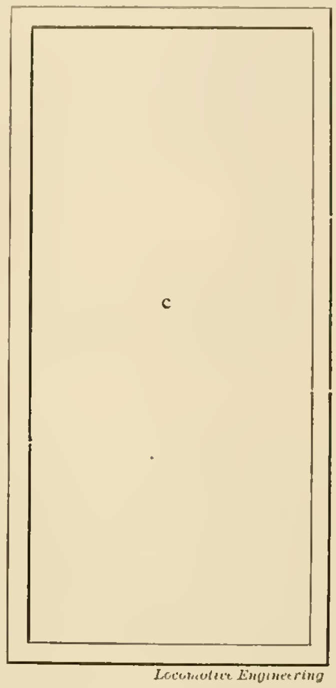


Fig. 5

BALANCED VALVE.

from the top to bottom, and leakage, never growing better, would be the inevitable result. He worked hard to develop good points in the construction of his balance valve, and, beyond doubt, succeeded in doing so. Later on, in another position, I designed and superintended the application of a very considerable number of his valves to stationary and marine engines, without a failure in a single instance. I remember an instance in which the application was to a 20-inch cylinder engine that had been running for a year or two. The pipe leading from the space inclosed by the packing strips—the relief pipe, we called it—was about 6 inches long and 1 inch diameter; opened direct into the engine-room. The reason for the pipe being so large was, that it was put there by another party who had made a failure in trying to balance that same valve. After two or three days there was scarcely a perceptible leak of the packing, all of which leakage must pass through this pipe, and after ten years' use you could safely place your cheek within an inch of the open end of the pipe. This was not an exceptional, but a common instance.

It should be stated that in the particular instance mentioned, and others incidentally referred to, there was no possible interference from sparks, and the main valve—the one balanced—had a constant travel, and not a variable one, as in the instance of a locomotive—two very important differences.

Like all first-class mechanics and engineers—and Richardson was both—when he turned inventor rather in earnest, he was not satisfied with the balance packing of his valve. He wanted to see

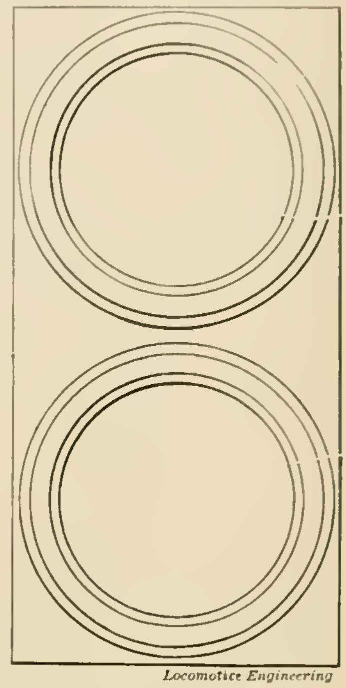


Fig. 6

BALANCED VALVE.

how it would go some other way, and as the sparks still worried him somewhat, he arranged for a continuous packing, as represented in Fig. 5. The central part of this piece *c* was slightly depressed, the outside, as shown, packing against the packing plate, instead of the four packing strips. I never seriously believed that Richardson thought this packing good for anything, which it certainly was not. Then he tried circular packing rings, as indicated in Fig. 6, but, as might have been anticipated from the variable travel of the valve, with no better results.

In the beginning of his experiments, Richardson knew nothing of how much pressure he could take from the valve and still have it seat securely. Such information as he had, came from John Bourne's statement, in relation to the balanced valve of Messrs. Penn, to the back of which he says "a ring is applied, of an area equal to that of the exhaustion port." Guided in part by this, he balanced his first experimental valve to the extent of the exhaust cavity in the valve, which he assumed Bourne to mean.

Richardson was the first I knew of to reason that the area balanced was somewhat greater than the area inclosed by the packing strips. He reasoned that the conditions existing as to pressure in cavity *c* extended to an uncertain distance over the tops of the packing strips, making the balance greater than might be inferred.

Later on, Professor Robinson* instituted some experiments going to demonstrate that the rather prevalent opinion, that the downward pressure on a slide valve was that due to the pressure over the ports only, was wrong. That is, the assumption was that, if you placed a disk over an aperture through a steam box, Fig. 7, the force required to lift the disk would, in pounds, be the area of the aperture in square inches, multiplied by the pressure per square inch in the steam box. Professor Robinson showed that, with the disk accurately ground to its seat, the force required to lift it would be the pressure multiplied by an area extending outside the aperture, as to the dotted lines. However interesting these experiments might have been to Richardson, if they had been made before he had worked out his problem of balancing valves, it is doubtful if they would have been of any practical value. Unfortunately, the finer experiments of this kind are conducted—the better the surfaces in contact are—the less instructive they are to any but a purely scientific mind. In the instance of a slide valve, if springing from pressure and heat does not at once destroy the fine fitting of the valve, a few days' use is sufficient to most effectually do so.

Richardson's conclusions were, that he could tell nothing about the matter, except with the valve under ordinary good working conditions. Having good opportunities to experiment, he began, as said, by balancing the valves to the extent of the exhaust cavity. Then the area balanced was gradually increased, until the valve unmistakably left its seat. I cannot recall to what extent the balancing was carried before this occurred, but I do know that Richardson's conclusions at the time were that, taking locomotives as they went, it was not wise to balance more than the exhaust cavity in the valve and one-third the area of one of the steam ports. This, it will be seen, in the instance of a large valve and high steam, removes a pressure almost enormous.

The variable conditions that prevail in regard to balancing locomotive valves, as indicated, may be seen from an inspection of Figs. 3 and 4. In Fig. 3 the valve is represented as being at the center of its travel. The ports are equally covered, and the pressure in ports p and p' may be assumed to be about equal. The pressure to seat the valve is very well distributed. The part of the valve that is relieved is central with the wearing surfaces, and the wear should be substantially equal. Assume the valve to have been moved along to the position indicated in Fig. 4. The pressure in port p' has been increased by compression until it equals, perhaps exceeds, that in the steam chest; while that in port p has fallen by its being opened to the exhaust. If now the valve is overbalanced, the right-hand end will be lifted from its seat, slightly, bringing about unequal wear of both valve and seat, which will begin as soon as, or even before, the exhaust begins to open. The only way for the practical man to study this as it ought to be studied, is in connection with indicator diagrams and a model valve motion. The manner of doing this needs no explanation. It will be readily understood that when there is a strong tendency to tighten the valve at one end, and loosen it at the other end, if the valve is slightly overbalanced, the

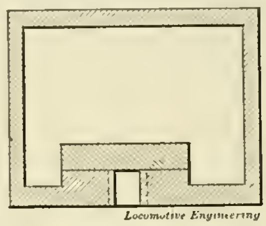


Fig. 7

BALANCED VALVE.

wear will be as indicat d by Mr. Hungerford. The cause, in his case, as editorially assigned, may be the principal one, or it may assist overbalancing. From the experience I had in assisting Richardson, I should incline to the belief that overbalancing had at least a share in the work, but the data is insufficient to sustain any argument in regard to this.

F. F. Hemenway.

Brooklyn, N. Y.

* See Transactions A. S. M. E., Vol. IV.

Saving from Variable Nozzles.

Editors:

In the February issue I wrote you concerning the performance of the new variable nozzle, the property of Messrs. Wallace & Kellogg, of Altoona, Wis. I will now inclose you a special performance sheet for December and January last past. During the month of December, the variable nozzle was set at 2½ square inches larger than original nozzle, with reverse lever in either corner. On January 1st it was enlarged to 4.28 square inches larger in either corner; this should increase the mileage for January over December; but during the month of January, the engine was sent out with a combination snow plow and flanger, after a severe storm, and used 11 tons of coal making 272 miles. This, of course, reduced the mileage considerable, but leaves a very good showing.

On a basis of 2,619 miles, which was made by this engine in December with coal at $2.58 per ton, there was shown a saving of $59 over the general average of the other engines on the same run.

In January, on a basis of 3,468 miles, there was shown a saving over the general average of $83.85, or 32.5 tons of coal.

I might add that this engine left the shop November 30th, and has been running every day. The front end has never been opened for cause, and there are no signs of gumming. All adjustments of the nozzle are made from the outside, so that it is unnecessary to open the smokebox door.

L. H. Bryan.

Two Harbors, Minn.

[The special performance sheets referred to show that in December, 1896, the engine with the variable nozzle made 35.9 miles to the ton of coal, as against 28.1 miles average of five other engines; in January, 1897, the miles made per ton of coal were 31.9, as against 24.6 by the others.—Eds.]

Pounding on Left Side.

Editors:

Pounding on left side of right-hand lead engines is a fact long observed by locomotive engineers, in general, with but passing interest, as shown by lack of any heretofore advanced theory as to its cause. Some have sought to account for it from the fact of the engineer being placed on the right side, and being at a distance from the trouble was made negligent of his duties on the left. My explanation is as follows:

A right-hand lead engine approaching right forward center, the left-hand piston would be pulling the driving box forward against the wedges, and finding them a fulcrum, would tend to force the right-hand box back against the wedge after the exhaust was made on that side, and when steam was taken on center, the box being held against wedge by strain of left piston, there could be no pound on that side. When left side reached center, and exhaust was made, the strain of right piston would, by aforesaid process, force the left-hand box forward, and when steam was taken, the box would thump against back wedge, as the lost motion was all taken up forward by the action of the right side. When same engine is run backwards, the thump would be transferred to right side, as a right-hand lead engine going forward is practically a left-hand lead engine backing up. Do you think I am right?

John Loftus.

Albany, N. Y.

[The theory is quite rational and may be correct.—Eds.]

Watch This Hotel "Dead Beat.

Editors:

Some rascal is traveling around the country, passing himself off as Mr. F. F. Prentiss, of this company; he has a facsimile of Mr. Prentiss' card, and his signature is a close copy of that of our Mr. Prentiss. This fellow is beating hotel proprietors out of their board bills, and may be attempting other deviltry of a "confidence game" nature. We think you would be doing the public a good turn by publishing this notice.

Cleveland Twist Drill Co.,

By J. D. Cox, Jr.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

"The Air Brake Has a New Enemy."

Ever since it was announced that Mr. G. W. Rhodes, superintendent of motive power of the Chicago, Burlington & Quincy Railroad, would read a paper on the above subject before the January meeting of the Northwestern Railway Club, considerable speculation has been indulged in by air-brake men as to the character and nature of this "new enemy." Some thought the "new enemy" might be a practice recommended by some well-meaning person, but which really resulted in detriment instead of good. Others had in mind the trainman who tests brakes with the rear angle cock; the chap who adjusts piston travel by brake-shoe clearance; the yard master who obstructs the switching ahead of air-braked cars, and various other offenders. Of course, all these were old, and we did not presume for a moment that a thorough air-brake man, like Mr. Rhodes, was ignorant of their existence. The greater portion of those who wondered were entirely in the dark, and welcome the light thrown on the subject by the reading of the paper by Mr. Rhodes.

The "new enemy" turns out to be a common, ordinary mud wasp—a transient inhabitant of the West and Northwest—which seems to have a penchant for traveling. This insect chooses for its place of habitation the exhaust port of the pressure-retaining valve, and there builds a nest of mud and other material, in which it rears its young, thus effectually closing up all avenue for the escape of pressure from the brake cylinder. After describing the trouble and giving a treatise on Entomology, with especial reference to the origin and habits of this particular insect, Mr. Rhodes suggests a remedy for the evil, in changing the shape and size of the exhaust port from its present annular opening to one slit-shaped, thus preventing the insect from entering the retaining valve.

In order that the dirt may be gouged out of the retaining valve port, Mr. Rhodes recommends that the valve be changed from the position it now occupies. As it now stands, the outer face of the exhaust port is but a short distance from the side of the car, and is very difficult of access, should it be necessary to gouge out the port. The present location of the retaining valve, in reference to the position of its exhaust port with the side of the car, is advantageous, inasmuch that it precludes plugging up with a wooden plug, by the well-meaning trainman, who believes that he is thereby correcting a leak. The change in the shape of the opening would not only bar out the insect, but would also prevent the brakeman from using wooden plugs in retaining valves.

Fourth Convention of Air-Brake Men.

The fourth annual convention of the Railroad Air-Brake Men will convene in Nashville, Tenn., April 13, 1897.

The progress made by this association in the last four years has been remarkable, and evidence of its success is shown in the unprecedented sale of their proceedings up to date. The first edition of the 1896 proceedings, of 4,000 copies, was scarcely off the press before a second edition of 4,000 more was necessary. This second edition has been almost entirely disposed of, and the demand, although somewhat abated, has not entirely ceased.

Instead of printing a third edition of the proceedings, the progressive form of questions and answers, which has so greatly influenced the sale of the 1896 proceedings, has been published in pamphlet form, and will be sent to any address by "Locomotive Engineering," at the following rates: Single copies, 25 cents each; 10 copies, 20 cents each; 100 copies, 15 cents each; 500 copies, 12 cents each; 1,000 copies, 9 cents each.

A New Catalog.

The Westinghouse Air Brake Company has recently issued its new 1897 "F" catalog, which is much fuller and superior to all former publications of this kind.

The principal features of improvement consist of the illustration of the high-speed brake, which has been standardized, and is now placed on the market. Heretofore, the high-speed brake has been considered merely experimental, but has now become a regular article of commerce, especially adapted to fast train service.

The engineer's equalizing brake valve, with feed attachment, is now known as Plate F-6.

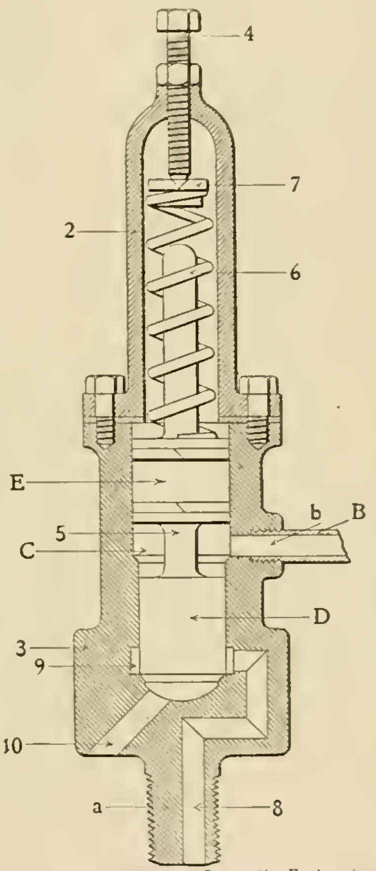
The special equipment for certain classes of hopper-bottom coal cars where single cylinders cannot be used, now consists of a "twin" brake apparatus, in which two cylinders of 6-inch diameter and 8-inch stroke are supplied by one common auxiliary reservoir.

The plain triple, special driver-brake triple, quick-action passenger triples for 10-inch, 12-inch and 14-inch brake cylinders, all have graduating springs, made of No. 14 phosphor bronze spring wire, 12 coils, 2½ inches free height after taking permanent set. The graduating spring for quick-action triple valves on the 6 and 8-inch freight cylinders are made of No. 15 B. W. G. brass wire, 14 coils, 3 inches free height after taking permanent set.

The Silvene Quick-Release Valve.

Editors:

The purpose of the present invention is the provision of a release valve for the air cylinders of automatic brake mechanism, which will be self-acting and quickly respond to the variation in pressure of the air in the train pipe, so as to quickly



SILVENE QUICK-RELEASE VALVE.

relieve or bleed the cylinder when it is desired to release the brakes, so that the latter will be quick in the releasing action.

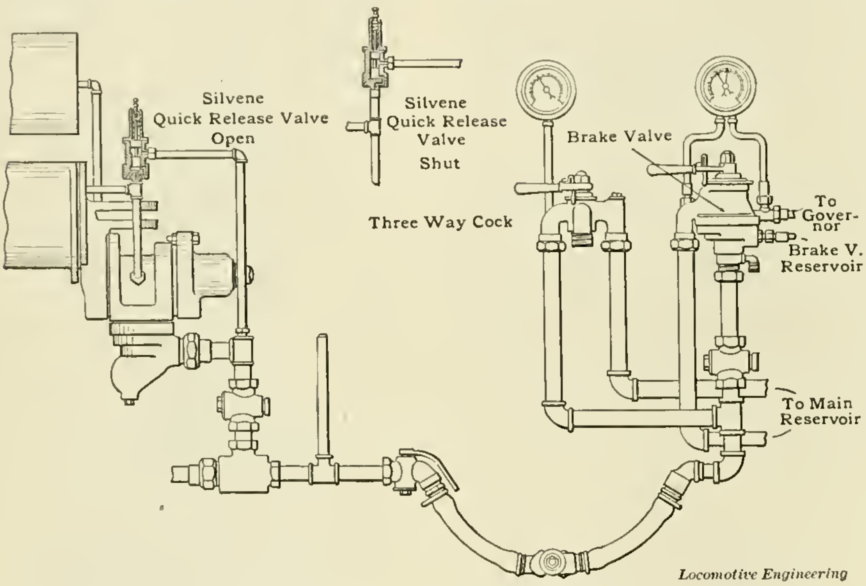
With these ends in view, the invention consists essentially of a release valve, embodying in its construction two pistons of differential areas, comprising between their opposing ends a chamber which is in communication with the train pipe, the smaller piston closing two passages, the one leading to the brake cylinder, the other to the outer air.

The improvement consists essentially of the novel features and the combination of the parts which hereinafter will be more fully described and claimed, and which are shown in the accompanying drawing, which is a vertical central section of a valve constructed in accordance with and embodying the essential principle of the invention.

The valve case is composed of two parts 2 and 3, which are secured together by bolts or other fastenings, passing through the opposing flange ends.

The upper part 2 is closed at the outer end, which end is centrally apertured and internally threaded to receive a set screw 4.

The lower part 3 is provided with a nipple *A*, by means of which communication is had with the brake cylinder and with a lateral opening *b*, which makes connection with the train pipe *B*. The upper part of the bore of the part 3 is larger than the lower part of the said bore, and



SILVENE QUICK-RELEASE VALVE APPLIED TO AIR-BRAKE SYSTEM.

between the two is provided a chamber *C*, which is about opposite the opening *b*. Two pistons *E* and *D* are connected or form part of a valve stem 5, which latter is projected into the chamber formed in the part 2, and receive a coiled spring 6, which is confined between the piston *E* and a flanged nut 7, held in engagement with the inner end of the set screw 4.

The two pistons *D* and *E* are in axial alignment, and fit steam-tight within their respective bores.

The passage 8 is provided in the nipple, and communicates with the brake cylinder, but extends vertically through the lower portion of the part 3, and communicates with an annular chamber 9. A relief passage 10 leads from the chamber 9, and is designed to carry off the spent air from the brake cylinder, when it is desired to release the brakes.

Having thus described the invention, what is claimed as new is:

A release valve for the cylinders of an automatic brake mechanism, comprising a casing adapted to make connection with the brake cylinder and train pipe; two pistons of differential areas operating in the valve casing and comprising a chamber between their opposing ends, which at all times is in communication with the train pipe; two passages, the one communicating with the brake cylinder, the other with the outer air, and controlled by the smaller of the two pistons, and a spring similarly exerting a pressure to close the piston and cut off the communication between the said two passages, substantially as set forth. A release valve to hold the air in the brake cylinder to recharge the auxiliary with the brake set.

If you carry a train-line pressure of 80 pounds, you will set my improved valve for 85 pounds; or if you carry 70 pounds, you can set the valve for 75 pounds. After the engineer makes a reduction of 5 or 10 pounds, he places the brake valve on the running position. Of course, the brakes will remain set until the engineer works the three-way cock. He recharges the train-line with 5 pounds pressure; this will lift the release valve off the seat, as it shows in the blueprint, the position it stands in when it is releasing the air from the brake cylinder.

When the trainman wants to throw out a car, the engineer recharges the train-line before they cut the air off; that will keep the valve in the release position. The engineer can prevent the brakes from sticking with this valve, by carrying an excess pressure in the main reservoir on the locomotive.

TONEY SILVENE.

Victoria, B. C.

[The reasons why brakes should not release any sooner than they do, are so obvious that it does not seem necessary to enter deeply into a discussion of our correspondent's device in this connection, and inasmuch that the device is more of an automatic recharging device, instead of a quick release, our remarks will, therefore, be confined to the former.

Plainly stated, the functions of our correspondent's valve are such that the differential piston is controlled by the spring 6, and remains seated until such time as the train-pipe pressure, admitted between the differential heads of the pistons, is such as to force the piston upwards, thereby making a communication between the brake cylinder and the atmosphere. The spring in question is set at a certain pressure, and so long as the train-line pressure is under that amount, the exhaust port is closed. To open the exhaust port, the train-line pressure must be increased to the necessary amount. In short, the valve closes the exhaust port to cylinder until such time as train-line pressure is increased to the predetermined amount necessary to overcome the tension of spring and lift the differential piston valve.

This device contains the same inherent objections as similar devices. Should there at any time be less pressure in the train pipe than will overcome the tension of the spring 6, the brake will refuse to release, as the brake-cylinder port is blocked. The remarks which we made on a corresponding device in last month's issue, will apply to this device, in the respect of brakes remaining set until a certain train-line pressure is obtained.—Eds.]

Quick-Charging Triple Valves.

Editors:

In the Air-Brake Department of December number you say that henceforth you will draw the line at illustrations and descriptions relating to quick-charging triples, and assert that if a quick charge or recharge were desired, the enlarging of the feed groove would accomplish that.

It is undoubtedly true that a quicker release is not needed, and that the complication and expense of a double train pipe debars that, but is not a quick recharge very desirable, were it not for the unequal recharging difficulty which would attend a very long train? I do not believe this trouble exists in a train pipe the length of a passenger train of ten coaches or less.

Should it be decided to recharge the auxiliaries of passenger cars in less time than they are now recharged, it would be a change very desirable to those who handle the brake, but seemingly undesirable to some air-brake theorists.

This change, however, could not be brought about by simply changing the size of the feed groove, as any change in that would necessitate a larger preliminary exhaust port, and a stouter graduating spring, and this would in turn interfere with the emergency action.

I fully realize that I have not said anything which you and others do not already know; but there are a great many more whom your statement misleads.

About two years ago I witnessed a number of tests which convinced those present that the auxiliaries of a passenger train could be recharged quickly without the attendant troubles which are encountered on a very long train, and as passenger coaches are not mixed up in fifty-car trains, the argument put forward, that there would be inharmonious action of the two different triples, surely does not hold good.

These tests were made with three Westinghouse passenger triples, which had been fitted up with ¼-inch piping, a small check valve, and small ports bored in triple-valve piston casing, which became uncovered when triple was in release position. The small check valve prevented a return flow of air when light reductions were made, and it did not interfere with the service application.

These triples were first put into service on a train of from three to five cars, for a number of trips over a division of 190 miles, with two very heavy hills on it. One of these hills averaged 150 feet to the mile for 10 miles. In one test the retainers were not used on this hill, and on account of the quick recharge, no trouble was experienced in keeping the train fully under control; the auxiliary reservoirs, according to gages attached to them, being fully recharged after brakes were released, before the train had gained headway enough to necessitate another application.

When making station stops and stops for water tanks, where a second application of the brakes was sometimes necessary, the gage showed that the train line and auxiliaries had equalized at a higher pressure than they generally do, which gave opportunity for a much better stop, and no chance for that disagreeable lurch, the result of a difference of pressure between train line and auxiliary.

The different engineers who went out with this train, found that they could release their brake where necessary, and reapply it with the maximum pressure in the brake cylinder in about one-fourth the time that they could before, which is surely a great benefit, especially when an emergency application is needed about fifteen or twenty seconds after brakes have been released.

An air-brake expert was asked for his opinion of this improvement, and he immediately condemned it, because it would not work successfully on a longer train.

Another test was made with nine empty coaches, three of them being equipped with the quick-charging triples, and at different speeds no break-in-twos, "terrible shocks," nor any shocks at all, were felt; but it was noticed that whenever brakes were applied in ten or fifteen seconds after a release, about 20 per cent. more braking power was obtained on each of those three cars than was obtained on any one of the other six, both in service and emergency applications. It is just this big advantage which seems to be its greatest and only fault, as the statement was then made that those three cars were doing too much towards stopping the train, and therefore did not work in harmony with the other six. This is undoubtedly true; but instead of destroying that increased efficiency, why not increase the braking power on those other six cars in the same manner? Then there would surely be harmony of action. If a quicker recharge of the auxiliaries of fast passenger trains were allowed, that dangerous period of time between a release and a recharge would be decreased to a minimum, and would be welcomed by all who use the brake. Passenger-car triples and freight-car triples are kept distinct and apart from each other, and surely Master Car Builders' standards are not so sacred that they could not be broken where a benefit was to be derived.

J. MILNE.

Ishpeming, Mich.

[The quick re-establishment of maximum pressure in the auxiliary reservoirs after the release of brakes is not, in itself, objectionable. On the contrary, it would be highly advantageous and desirable, providing a practically instantaneous recharge could be made without interfering with other things.

There is no reason why an interim of any specified time should elapse between the release of brakes and full accumulation of maximum pressure in the auxiliary reservoirs, except in the hindrance which such operation inadvertently offers to the performance of other functions of the brake.

If the recharging pressure could be simultaneously placed in the train pipe at each triple valve, so that all auxiliary reservoirs would begin to receive their charges at the same time, it would not matter how rapidly the recharging pressure would pour into the auxiliary reservoirs. But the fact that the pressure for recharging must come from the main reservoir on the engine, and must consume time in traveling through the train pipe, prevents the arrival of the pressure at each triple simultaneously and a uniform feed to all auxiliary reservoirs. The pressure in the forward end of the train pipe will be higher than that which reaches the rear end, and will, consequently, give a greater charge to the forward auxiliary reservoirs. This difference in charge is aggravated in proportion to the increased size of the feed groove in the triple valve, and the increased length of train pipe.

By the time the pressures in the forward and rear ends of the train pipe have equalized, the forward auxiliary reservoirs will have the higher pressure. The rear auxiliary reservoirs will not have done feeding yet, and will therefore continue to draw from the train pipe. In thus drawing from the train pipe, the rear auxiliary reservoirs reduce the pressure in the entire length of the train pipe, which leaves the forward reservoirs with a higher pressure than the train pipe, and their triple-valve pistons are consequently forced to application position. The entire train line and rear reservoirs must then be pumped up equal with the head reservoirs before the forward brakes will release.

The early type of plain triples recharged in a few seconds. That was when lighter cars and shorter passenger trains were hauled. When heavier cars and longer trains came into use, the necessity for reducing the size of the feed groove, to overcome the evil of unequal charging, was recognized. Some of the old triples, with large feed grooves, are still in use on tenders, and many an engineer who left his handle a little too long in release position before returning to running position when releasing brakes, has wondered why his tender brake would release and reset.

Some air-brake repairmen have filled the large feed groove in the old triples with solder, and cut therein a smaller groove, which largely overcomes the trouble just referred to. The fact that the feed grooves in triple valves have been larger than those now used, disproves the assertion that if the present groove were to be enlarged, a necessary change would have to be made in the preliminary exhaust port, the service exhaust port and the graduating spring.

Ninety pounds main reservoir pressure, thrown into a train pipe of thirty cars whose brakes are set and whose train line pressure is about 50 or 55 pounds, will charge the auxiliary reservoir of the first car several pounds ahead of the thirtieth car.

Professor Dudley found that it took from six to ten seconds for pressure, after being admitted to train pipe, to reach the rear car of a fifty-car train. On a twenty-five freight-car train, it would be half of this, and on a ten-car passenger train it would be a little less.

The advantage given the forward reservoirs by these few seconds in time and momentary higher pressure does not seem to be material, yet it is sufficient to cause trouble and give foundation for the objections above referred to.

Another serious objection to a quick-charging triple valve is that the forward triple valves are forced to release position, and their auxiliary reservoirs are opened up to receive the charge which should go to the rear cars to throw their triples to release position. Of course, the shorter the train, the less liable will brakes be to refuse to release. But different lengths of trains and variation in piston travel are matters beyond the control of the man handling the brakes, and would prove a serious obstacle to the successful performance of quick-charging triples, except under more favorable conditions than could be obtained for them in actual service.

If the recharging pressure could be transmitted with electric speed from the main reservoir equally to each triple valve, throwing each triple piston to release position, then instantly recharging all auxiliary reservoirs to maximum pressure, an ideal system would be had; but, as this is a physical impossibility, the nearest approach to it is the restriction of the feed groove which will allow the charging pressure to first move all triple pistons to release position, and then permit all auxiliary reservoirs to begin and end their recharge as nearly together as physical laws will allow.—Eds.]

The Pioneer Engine-Truck Brake and How It Came to Be Applied.

Editors:

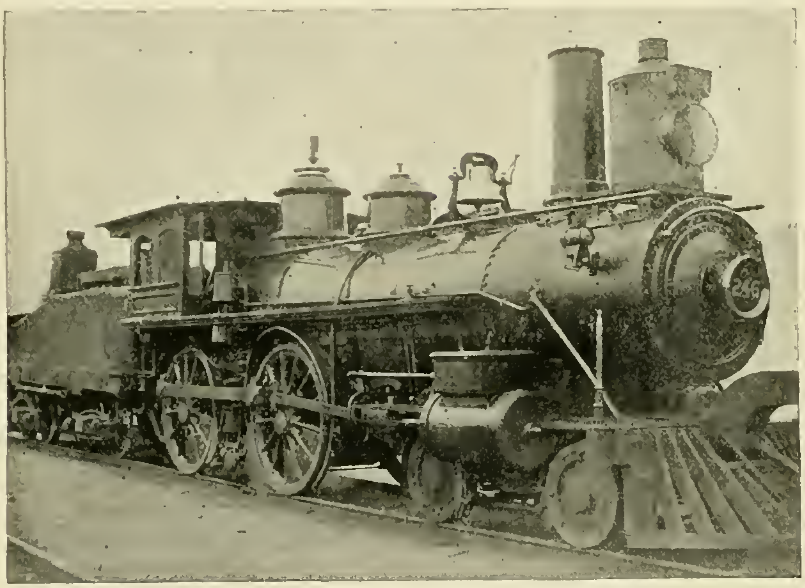
In the year 1889 the Canadian Pacific Railroad Company put on a suburban train to run over a certain part of its line. Up to this time this work had been done altogether by a neighboring road, and when, for the convenience of passengers, the train in question was started, it was run exactly on the same time as the train on the other road, and it might be well to mention that these roads ran side by side for the whole distance, and the stations on each were directly opposite to each other.

The train consisted of two 50,000-pound cars and a four-wheel coupled Manchester engine, with 16-inch cylinder and 62-inch wheels. The tank was sloped to the back, and a pilot put on the back of the tender, as there was no means of turning engine at one end of the run.

A few passengers patronized the new train; but when it was found that the little engine could not get there on time, and make all the stops, which were thirteen in a distance of 23 miles, they made very broad hints of going back to the other line.

The engine on the other road was a remarkably good one, and was built for that particular service, with the water tank on the boiler, and it used to get out of the station with such surprising speed that the little Manchester could have a good view of the rear of that train when it did not get the smoke. This was too much for the feelings of not only the passengers, but engineer and conductor, and the former, in his eagerness to make better time, sometimes did not stop just at the station, even with the engine reversed, and the latter, with many apologies, would assist the passengers to alight at the road-side.

The brakes on the cars were in good order and fully equal in power to ninety per cent. of weight of car; the tender brake was equally good; but the driver brake was of the pull-up type, with the usual gland leakage. To keep the piston packing tight, the engineer was accustomed, when oiling, to carry an oil can in one hand and a water can in the other. This brake was made to do good work by turning the cylinders upside down, changing the pistons on the rods, putting on a long crosshead, and making it push



CANADIAN PACIFIC ENGINE, WITH FIRST FORWARD TRUCK BRAKE APPLIED.

up instead of down and use no gland. Bright sheet tin was placed between the cylinder and the firebox, and the leather packing was put in quite dry. The bright tin acted as a non-conductor, and kept the cylinder much cooler.

After this was done, the time made was so much improved that the value of a brake for making time began to dawn upon the writer of this article, who at the time had charge of the mechanical department at that point. There were two pair of wheels yet in the train without a brake—the engine truck, with a weight of 25,000, the energy of which pulled the train by the station, and made it necessary to shut off sooner.

Why not put a brake on the engine truck? The reasons against it were, that no such brake had yet been used, and the engine truck was supposed to be free to curve. The reasons for it were time and safety, and that this engine had a brake on the leading truck when running tender first, which furthermore hung to the tender frame, while the engine-truck brake could be made to hang to the truck itself.

An 8-inch cylinder, a 10 x 24-inch reservoir, and a triple valve, were soon on hand. Slab-iron brake beams, with wrought-iron brake heads, were quickly made and placed inside of the wheels, over pedestal braces, so that no safety hangers were needed, and a braking power of ninety per cent. was employed. The result was that the little engine brought its train in sharp on time, to the satisfaction of everybody.

The accompanying photograph is of the engine with the first engine-truck brake.

C. R. Ord,
A. B. Insp., C. P. R.

Montreal, Can.

Would Such an Exchange Be Wise?

Editors:

I saw in a number of "Locomotive Engineering" the statement that anything could be done with a second line of air pipes for train brakes, except to get railroads to buy them. You add that the reason is the extra cost and trouble.

Now, it seems that the advantages to be derived therefrom would far overbalance this cost and trouble. By its use the auxiliary reservoirs could be automatically supplied with air. There would be no need of retaining valves. It could be so arranged that the rear brakeman could use the brakes on any given number of rear cars to keep up the slack in couplings on grades, and not interfere with the engineer having the use of all the brakes when needed. Also, in case of anything occurring to the main train pipe, so that a car, say in the middle of the train, or any other place in the train, had to be cut out, and thus cut off the supply of air from the rear cars, the brakeman could use the brakes on all cars in the rear, and the engineer of those in front of the disabled car.

In case of long trains, the brakeman could make the right stop on the rear cars at stations, saving time and trouble. If lower pressure were used, there would be few if any hose bursted or pulled apart. This last would save far more than the extra cost. If these results can be made to follow, would it not be true economy for railroads to adopt the plan? Is it good policy for railroads to adopt any particular plan, and force everything to conform to that style? Certainly, that is a stumbling block in the way of inventive improvement.

The writer of this recalls when one of the locomotive builders of this country wrote against link motion for locomotives. To-day all locomotives (nearly) have the link. Would it have been good policy to have adopted the valve motion of that day, and thereby stopped improvement therein?

Benjamin Smith.

Princeton, Ind.

Information on the Loughridge Brake.

Editors:

The Loughridge brake was used by the Tioga Railroad from 1876 to 1882, at which time the Erie Railroad purchased the road, and patterns and blueprints of the brake were then sent to Susquehanna, Pa.

J. A. HADLEY.

Elmira, N. Y.

A Brake-Valve Trouble.

Editors:

I had a D-5 brake valve taken off of our engine and another one put on. The first time I got the engine after the valves had been exchanged, I started the air pump, and the main reservoir pressure ran up to 85 pounds, but the train line showed nothing. I then put the handle in release position, and the train-line pressure ran up to reservoir pressure, 85 pounds. I supposed the trouble was in spring 68 not being adjusted properly. I took off cap check nut 71, and ran nut 70 up as far as I could get it, and still no pressure showed on the train line with engineer's handle in running position. I then examined the feed-valve attachment, and found it all right. I took cap nut 65 off, took spring 64 and feed valve 63 out, and put nut 65 back on. Then set the brake valve handle in running position. The train-line pointer ran up to reservoir pressure. I did this, thinking the gasket between feed-valve attachment and brake valve had closed port *f*. Finding that "O. K.," I put the feed valve and spring in, and then attempted to adjust the train-line pressure again with nut 70, but with same results. After thinking a few minutes I found the trouble, which was as follows:

The bottom part on feed valve 63, which rests on the diaphragm 72, was too short, and allowed the feed valve to seat, regardless of any position you could put diaphragm piston in, by running nut 70 up. I went to the roundhouse and took the feed valve out of the one they took off, and put it in the one they put on and it then worked "O. K."

J. E. C., Engineer, P.R.R.

Williamsport, Pa.

Air Brake Items.

The Fourth Annual Convention of the Air-Brake Associations convenes in Nashville, Tenn., April 13th, and will probably be in session three days.

Correspondents sending articles or question for publication must sign their names in full. Two air-brake articles are held out this month, awaiting signatures.

The D-5 or E-6 brake valve is designated as Plate F-6 in the new W. A. B. Co. 1897 "F" catalog. This triple-headed name may be a trifle confusing to some for a time.

Brown's discipline on the Fall Brook road has reduced wrecks and breakages 66 per cent. since suspension was abolished. We naturally wonder if the breakages referred to include those due to misuse of the emergency, and break-in-twos due to hand brakes being set on the rear cars of a partially equipped air-brake train?

Frank Richards, in commenting in his book, "Compressed Air," on the functions of oxygen and nitrogen in their constituency of air, says: "A friend who is blessed with more knowledge in this line than is possessed by the writer, suggests that oxygen is made for the mechanic and nitrogen for the farmer." A Waynesburg, Pa., farmer, however, evidently refuses to accept such division, and seems to covet the mechanic's position also, for he recently applied for, and was granted, a patent on a "Pneumatic device for stacking straw."

"A brake shoe comprising a highly compressed and substantially homogeneous moisture-proof block of wood, in which the natural fibers remain unbroken and in their natural arrangement, and from which the softer substances have been largely removed so that the fibers lie in a closer and more intimate relation than when in the natural state, the block so positioned that the ends of the fiber are exposed to the wheel, the wood so treated as to be proof against charring by the heat developed when in contact with the moving wheel," is the claim of a recently granted patent.

The Q. & C. Co., of Chicago, Ill., is sending to members of the Air-Brake Association and others a pamphlet on the McKee slack adjuster. This little book treats in a simple and comprehensive manner, Running and Standing Travel; Total Leverage; Lost Travel; False Travel; Shoe Clearance, and other interesting and instructive matter pertaining to air brakes, and should be in the hands of those who would know the relation of the slack adjuster to air brakes and foundation brake gear. Much credit is due the Q. & C. Co. for developing this part of the subject and getting the matter in shape for air-brake men.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(26) J. J. H., Montgomery, Ala., asks:

How would the brakes work on engine and tender, on a train of any length, with the main supply port *a* in the rotary valve of D-8 brake valve plugged air-tight? A.—Brakes would stick and refuse to release.

(27) F. S., Hoboken, N. J., asks:

1. In figuring out cam-brake power by "Wahlert's" Rule, do I understand that the 1/8 wire is only placed between one shoe and the tire, or between the two shoes and the two tires? A.—Between one shoe and the tire. See sketch on page 474, June number for 1896.

(28) F. L., Maywood, N. J., asks:

Will you kindly publish a way to figure out the power delivered by pull-up cam brakes, where the cams are connected direct to the shoes? A.—Use Wahlert's Rule, as given on page 474 of June, 1896, number. This rule applies to both pull-up and push-down cam driver brakes, with and without levers.

(29) H. G. A., Somerville, N. J., asks:

When renewing an emergency valve (rubber seat) after having removed pin through lower section of stem, how can I best screw out the top section with a certainty of not twisting it off at the thread? A.—Place the lower section of stem on something solid, and tap it lightly with a hammer; do not pound it.

(30) E. G., East Rutherford, N. J., asks:

Why is the proportion 4½ to 1 considered better than other proportions for brake-beam levers? A.—It permits the brake shoe to be located about 2 inches below the center line of the wheel, allows the top rod to clear the track bolster and the bottom rod to clear the spring plank, and gives an advantageous sweep of lever.

(31) T. S., Jersey City, N. J., asks:

When the brake leaks off in emergency, because cylinder pressure passes back into train pipe, which is to blame, check valve or rubber seat of emergency valve, which, I believe, is supposed to close when brake cylinder and train pipe pressures become equalized? A.—The non-return check valve is to blame for the trouble, and not the rubber-seated emergency valve.

(32) W. A. S., Memphis, Tenn., writes:

A says that driver brakes were put on engines to assist in making stops, and for the safety of passengers and crews. B says that they are to keep the tires worn down, and thereby reduce expense of turning up tires when an engine is being overhauled. Which is right? A.—A is right. Tire dressing shoes on a driver brake, however, will greatly increase the service periods between shopping for returning tires.

(33) T. S., Jersey City, N. J., asks:

Why was engineer's valve mentioned in "Locomotive Engineering" for September with port *A* near emergency exhaust port not brought into general use? A.—This valve gave way to the first form of D-5 brake valve. The small groove in the rotary valve now permits the equalizing reservoir pressure to exhaust to the atmosphere, allowing the black hand to drop to zero when the handle is placed in emergency position.

(34) E. J. H., Paterson, N. J., asks:

As smallness of ports leading to chamber D is responsible for the equalizing piston lifting when brake is released in light engine, why could these ports not be made larger? A.—Equalizing port "g" has been enlarged as much as possible for this purpose, but port "e" is also the preliminary exhaust port, and restricts the discharge of air from chamber D in service application; hence, its size is arbitrary and cannot be changed.

(35) E. J. H., Paterson, N. J., asks:

1. Has the small reservoir attached to engineer's valve got to be a certain size? A.—Yes. The size has been established by experiment, and, as used, meets requirements better than any other size. 2. What would be the result of its being larger or smaller? A.—If it were larger, a longer time would be required to make the service application, and some pistons might not get beyond their leakage grooves. If it were much smaller, emergency applications would follow when not desired.

(36) B. J. H., Bayfield, Wis., writes:

On plate No. 1 of J. E. Phalen's "Air Brake Practice" I find a cut of an 8-inch air pump that shows only one receiving and one discharge valve. As there is no explanation of the pump in the book, will you please inform me if there are two more valves, and if not, please explain how the pump works with only one receiving and one discharge valve. A.—The valves shown are the receiving and discharge valves for the upper end of the air cylinder. A similar set, located back of these and not shown in the cut, perform a similar duty for the lower end.

(37) T. S., Jersey City, N. J., writes:

1. Please explain in regard to lift of check valve in quick-acting triples; how long it is open and how much air passes through it—that is, how much does it reduce the train pipe? Does the valve not close, not when the train pipe and brake cylinder pressures are equal, but when the brake cylinder pressure plus the tension of the spring in the check valve become equal to the train-pipe pressure? A.—Only a fraction of a second. Your understanding is correct. 2. How much resistance has the spring in the check valve? A.—About 3 or 4 pounds when starting to lift.

(38) J. B. D., Arkansas City, Kan., asks:

For what is the small hole in the side of the pump governor between the diaphragm valve and the piston? All governors do not have this port. Why not plug it up? A.—To make the governor more sensitive, by allowing the pressure in the chamber to escape and the piston to rise, thus permitting the pump to resume work as soon as the diaphragm valve seats. Old governors without piston packing rings did not have this escape port, as the piston was sufficiently loose to permit the pressure to escape past it and out through the waste pipe. Don't plug up the port.

(39) E. G., East Rutherford, N. J., asks:

Why is one cylinder of an 8-inch pump larger than the other? A.—When the 8-inch air pump was designed, the standard steam pressure on locomotives was about 125 pounds, and in order to reach a high air pressure, the steam cylinder of the air pump was made 8 inches in diameter, and the air cylinder 7½ inches. Since then much higher steam pressures have come into use, and the 9½-inch pump, which supplies longer trains, has been designed with 9½-inch steam cylinder and 9½-inch air cylinder, and gives a sufficiently high air pressure without making steam and air pistons of differential diameters.

(40) F. S., Little Falls, N. J., writes:

What is the purpose of having a joint where the triple-valve piston butts up against the bushing in which the slide valve works? I don't know of anything there to keep tight, and a groove is cut through it, anyway, so air can pass, as, of course, it has to, to get into the auxiliary. A.—The end of the bushing in question in the triple valve is beveled to receive the beveled trunk of the triple-valve piston, thus guiding it and holding in central position in its cylinder. This also takes the force of the blow when the triple-valve piston is thrown to release position. See Question No. 24 in February number.

(41) W. S., Jersey City, N. J., writes:

1. Has there ever been, to your knowledge, any device patented, with a view to cause a freight car to brake according to the load it carried? A.—Such a device has been patented, but has not met with much success, on account of its numerous and expensive parts, which prevent it from entering regular service. 2. Would such a device not be a good thing, instead of having, for instance, two 30,000-pound cars having a capacity of 50,000 pounds each, one light, braking at 70 per cent., or 21,000 pounds, and the other loaded to its full capacity and braking at really less than 27 per cent? A.—Yes, it would be advantageous.

(42) J. J., Montgomery, Ala., asks:

If the air pipe between the brake valve and equalizing reservoir is broken, so that the reservoir can't be used, what course would I take in order that I might use the brake? A.—You could choose between two evils, the latter of which is probably the least objectionable. The first would be to put a blind gasket in the equalizing reservoir pipe at the brake valve, and attempt to make ordinary service application stops. The second would be to place a wooden plug in the train-pipe discharge angle fitting in the bottom of the brake valve, and use the emergency position as carefully as possible. The broken pipe should be repaired at the end of the run.

(43) F. L., Maywood, N. J., writes:

1. Why is the hole leading into the governor from train-line connection, and from diaphragm chamber down on top of piston, made so small? The latter is constantly gumming up, and refusing to shut off the pump, on that account. A.—It is sufficiently large to perform its function of admitting pressure to force the piston downward to stop the pump. It will not clog up if too much oil is not used in air cylinder of air pump. 2. For what is the hole sometimes found drilled through the steam valve of the new governor? A.—The late improved governors have this hole to admit a small quantity of steam to the pump, to keep it moving slowly, thus preventing condensation and freezing in cold weather.

(44) J. J. H., Montgomery, Ala., asks:

How can an engineer control his main drum pressure with the D-8 brake valve, with handle on lap and train-line exhaust plugged. As this is what the second man is recommended by some air brake men to do when double heading, if there is no cut-out cock in the train pipe under the brake valve. A.—Throttle the air pump. There are cut-out cocks furnished to put in the train pipe under brake valve, so that brake valve may be cut out when its engine is used second in a double-head train. If this cock is not put in the pipe, it is the fault of someone, and there is no need legislating for their negligence. Never place a plug, either of wood or iron, in the train-pipe exhaust except in cases of breakdowns on the road.

(45) F. H., Buffalo, N. Y., writes:

Every time the pump stops the tender brake will set. It will do this with light engine or train. Running or standing, it works just the same. There is no leak that I can find. The pump has the old-style Westinghouse governor, with D-8 engineer's valve. Pump will stop four or five minutes, then start and make a few strokes, and the brake will let off, but will set again as soon as the pump stops. Everything seems to be in good condition. A.—The governor piston is probably tight in the lower end of the cylinder. There is also probably a train pipe leak somewhere. It may be in numerous small places, and may possibly be in the diaphragm valve of the governor. A clogged leakage groove in the tender brake cylinder may assist in the performance.

(46) H. T., Paducah, Ky., writes:

I am pulling a three-car passenger train. Engine is equipped with Westinghouse latest improved appliances and has driver brakes. In making service stop I make first reduction of 4 or 5 pounds; second 2 or 3, and so on. Brakes work all right. At a junction I pick up another coach, make my first reduction as before, but when I make the second the brake on baggage car whistles off. Is this caused by surge of air or something else? A.—Clean the equalizing discharge piston. If this does not remedy the trouble there is probably a leak in the auxiliary reservoir pressure of the baggage car. Possibly the interim between your second and third reduction is greater than that between the first and second, which would account for this strange happening on the second reduction and not on the first.

(47) F. L., Maywood, N. J., asks:

What would be the effect of putting a freight triple on a passenger car? Some say it would apply in the emergency every time service stops were made. Others say that it would not unless stations were far apart, as it could not charge its auxiliary fully between stations of ordinary distances, on account of its smaller feed port. A.—The brake would apply in the emergency when a service application was made. The ports in the freight and passenger triples are different in size. This also applies to the port leading from the auxiliary reservoir to the brake cylinder. If the reduction from the train pipe is more rapid than the port leading from auxiliary reservoir to cylinder can accommodate, preponderance of pressure will be had on the auxiliary reservoir side of the triple piston, and will force it to the emergency position.

(48) J. B. L., Ashtabula, O., writes:

I had a D-8 brake valve with gasket leaking air from train line to chamber D so badly that the only way I could get brakes on, without going to the emergency position, was by allowing it to leak on from train line past the leaking gasket into chamber D. On a 34-car partially equipped air-brake train, would you consider it better to leak the brake on and avoid shocks to the train, or would you advise the emergency position for ordinary stops? A.—If you have only a few cars you might "leak" the brakes on successfully. If there is a number of air cars, the leak would probably cut little figure. It is possible that you might be obliged to use the emergency position as gently as possible until you reached the end of your run. This gasket, however, does not spring a leak suddenly, and should be discovered before it got so bad as to require such operation.

(49) T. S., Jersey City, N. J., writes:

Please publish a description of what you called the old center-feed triple valve. Many of the younger men never saw it, and would like to know what it was like. A.—Instead of a feed groove being cut in the side of the cylinder, as with the present triple, a port was drilled through the center of the piston nearly to a point where the graduating pin is now located. Here a cross-port was drilled, which, with the port just described, allowed air to feed from the train-pipe side into the auxiliary reservoir, when the ports were open. A projection on the graduating stem, smaller than the first described port, fitted very loosely therein. When the triple piston was in release position, the air would feed past this projection and charge the auxiliary reservoir. When brakes were applied, the piston would seat on a shoulder on the graduating stem and shut off communication.

(50) E. G., East Rutherford, N. J., asks:

In finding the total brake-beam leverage, why must brake-beam lever proportions be multiplied by only 2 for Hodge and by 4 for Stevens system? A.—There are four brake-beam levers on a car. With the Stevens system the proportions are multiplied by 4 to get the total or combined brake-beam leverage. To get the same for the Hodge system, we multiply by 4; but as half the pull goes to the hand brake with this system, we must divide our product by 2, which is equivalent to multiplying by 2 in the beginning. The hand brake with the Stevens system is connected to the top end of the dead lever. 2. Does the rule to multiply by 4 apply to the modified Stevens system now used on freight cars? A.—Yes. It must be remembered, however, that one cylinder lever, or the "floating" lever, as it is frequently called, is shorter than the regular cylinder lever, but it has the same proportions.

(51) W. S., Jersey City, N. J., writes:

1. Of what use is the graduating valve in a triple? I have been shown a Westinghouse triple, with its graduating valve entirely removed, and working all right both alone and when coupled to other cars. A.—The slide valve does not have to move on every reduction; hence, there is less friction and greater sensitiveness had in valves where the graduating valve is used. One of the old-style triples had no graduating valve, and the slide valve moved with the piston in response to each train-pipe reduction. 2. On trains of ten or more cars the graduating spring can be removed without the triple going to emergency in making service stops. Why is this? A.—If train-pipe pressure is reduced gradually enough, it can be done. The slide valve then does the work of the graduating valve, as in the older form of plain triple. 3. When using the emergency, does the emergency piston in the triple seat itself as soon as the pressures become equal, or does it stay open until brakes are released? A.—The spiral spring between the non-return check valve and the emergency valve causes the emergency valve to close, and the piston to return to its normal position almost immediately after the emergency application.

(52) E. G., East Rutherford, N. J., writes:

1. Kindly explain quick action of triple E-27, in which auxiliary reservoir air seems to pass to the emergency piston in both service and emergency applications, according to drawing in E Catalog, '94. If this is so, what advantage, if any, is claimed for this form of triple? A.—The service and emergency applications of the E-27 triple valve are the same as those of the E-24 and E-32 triples, and the same ports are used. The drawing slightly misleads, inasmuch that the exhaust port, emergency port and brake cylinder port are not all in the same vertical plane and sectioned on the same line as the drawing indicates. The exhaust port and emergency port are sectioned on nearly the same line, but the brake cylinder port is considerably removed from this line, and should properly be shown by dotted lines. 2. Why do both emergency piston and seat have threads on them? A.—For accurate and convenient chucking in the lathe. 3. How is it some of the older forms of emergency pistons have packing rings? A.—The packing ring was once considered necessary to make a sufficiently rapid movement of the piston in emergency applications, but later on was found to be unnecessary, and was therefore abandoned.

(53) E. J. H., Paterson, N. J., writes:

Why does not piston of engineer's valve lift its full stroke in making, say, a 10-pound reduction on a 15 or 20 car train, as stated in answer to a question in August "Locomotive Engineering." Pressure off the top exhausts in a couple of seconds; during that time train-line pressure has only started to reduce; why won't it force piston all the way in trying to escape? Question No. 118 in the Air Brake Men's Proceedings for 1896 explains this, but I don't understand what is meant by the "volume of the train-line pressure and small reservoir pressure as compared to their respective openings." A.—Volume, or bulk of air, must be considered in this question as well as pressure. If the volume of air in a short train pipe is such that it will discharge at the angle fitting at an equal rate with that discharging from the equalizing reservoir through the preliminary discharge port, the pressures above and below the equalizing piston will keep about equal, and the piston will rise but slightly. If, however, there is a greater length of train pipe to draw from, the volume will be consequently greater, and having to discharge at the same angle fitting as the shorter train pipe, the discharge will require longer time and the piston will rise higher, because the pressure on the under side is so much higher than that on top. The rate of discharge from the equalizing reservoir at the preliminary discharge port is always the same. That from the train pipe at the angle fitting varies in length with the length of the train. The shorter the train, the less lift the piston has.

It is wonderful to see the ingenuity displayed by patentees of smoke-consuming apparatus in finding changes from all devices on which they can hang patent combination claims. One of the latest smoke consumers has been patented by Wm. E. Cole, Atlanta, Ga., and consists of air induction pipes which lead air through the walls of the furnace and inject it upon the surface of the fire. That invention was brought out by D. K. Clark over fifty years ago and patented. About a quarter of all the smoke-preventing devices in the world follow the idea of Clark's invention, and every year we find many new patents taken out wherein Clark's arrangement is the only thing of any merit.

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Be Courteous to the Drummer.

Nearly all business men have been more or less disappointed since the election, about trade reviving so slowly. A great many people seem to think that prosperity would come with a bound, but these people had very short memories of the way that trade revived after previous depressions. It is, no doubt, getting better all over the country; but the improvement is certain to be slow, and the slower it is, the greater certainty will there be of its working forward upon a sound, safe basis.

One of the signs of the times is the reappearance of the drummer. There has been so little business to solicit for the last few years that a great many supply firms took their travelers off the road; but we notice now, as a healthy sign of the times, that the glad laugh and hearty hand-shake of the drummer are to be seen and felt in every train and hotel all over the land. We hope our friends will give him a warm welcome, and if they cannot give him an order, at least give him a kind word. There are some railroad men who appear to think that it is a duty and pleasure to be discourteous with drummers who come to solicit business from them, but these are in the small minority, and we hope that every day their numbers will become less.

Railroad men in place and power should remember that the drummers who come to solicit the orders that may not be forthcoming, are merely doing the work they were employed to perform, and that the most persistent of the fraternity is probably a man whose native energy would make him a successful railroad manager if his lines had been thrown in that direction. The superintendent of motive power and the purchasing agent might do well also to remember that the topsy-turvy of time occasionally makes the purchaser become the seller, and when that happens, happy is the victim who bears a record of having been decent to all and sundry when he was in power. Some of the most successful supply men that have sold goods to railroad companies, come from the railroad ranks, but they have always been the kind of men who are popular in any position.

One of our most successful railroad managers remarked lately to the writer: "I always make it a point to see all newspaper and supply men who call at my office, and there are not many men that I converse with who fail to give me points worth remembering." That is a very sagacious policy, for the drummer who knows his business is an expert concerning the use and properties of the article he has for sale. The men who habitually receive the least courtesy from purchasers are those representing oil and varnish houses—probably because there are so many of them; yet we feel certain that many superintendents of motive power and purchasing agents could learn valuable facts about lubrication and varnishes, if they would encourage the agents of these commodities to tell what they know about their goods.

The same rule applies to the man representing all other lines of goods. If any appliance is not working properly, or any material fails to give satisfaction, find out what the representative of the article can tell about it. A case came to our notice recently of a high grade of steel, purchased to make milling cutters and similar tools that were failing by cracking. The representative of the steel, who was a practical man, went into the blacksmith shop and watched the operations of forging and tempering the articles. He concluded that the pieces were damaged in tempering and said so. The blacksmith laughed in his face, and told him that he did not know what he was talking about. At this, Mr. Drummer took off his coat and cuffs and asked for the use of a fire. This was granted, and the men stood round making fun of what they called the "dude blacksmith," but he quickly showed them how a milling cutter could be tempered without damage to the material, and there was no more complaint about that steel.

A certain railroad company had introduced the use of Allen slide valves on their fast passenger engines, and one of the latter became noted for doing the work badly. The men in charge had tried all sorts of changes in valve-setting, thinking that the seat of the trouble was there. A drummer, who was also an engineer, came along one day and found them going over the valves in the roundhouse. The steam-chest covers were up, and the exact way the valves were set could easily be seen. The drummer made a careful inspection and concluded that the valve-setting could not be improved. He then suggested to the foreman that the valves be taken out and examined. When they were on the floor, the drummer took a bucket of water and poured it into the auxiliary ports. One of them was water-tight. The core had moved and the upper part of the port was filled with solid iron.

Another defect, of a similar character, was discovered by a newspaper man after the roundhouse force had given up the case as being beyond comprehension. A locomotive came out of the back shop after a general repair, and there was something wrong with it. The engine would neither run nor pull trains as it did before going into the shop, and as other engines of the same class were doing. After hearing about the trouble, the newspaper man offered to apply an indicator to the engine, and expressed the belief that it would show what was the matter. An indicator had never been used on the road before, and there was general unbelief about anything of the kind being of any practical value; but the men in charge were persuaded to prepare the necessary attachments, and the work was done. The mean effective pressure was found to be about half in one cylinder of what it was in the other. It did not require much grasp of reasoning to infer that there was something wrong with the steam passages on one side. After a somewhat prolonged search, part of an exhaust nozzle was found in one of the steam pipes.

Kindness pays. Even a drummer or a newspaper man may be an angel of light in homely garb.

Effect of Anti-Railroad Sentiment.

There is no other single interest which has done so much to develop the natural resources of this country as railroads; there is no kind of public enterprise which has charged the public less for services performed; and yet it has become the fashion among a large class of writers and speakers to assail railroad companies as enemies of the country. The national progress and prosperity have been accelerated to a phenomenal extent by the enterprise of the capitalists who provided the means of building railroads into every region where development of freight and passenger business seemed possible; and the men who risked their money to perform this great national service are habitually denounced as suckers of the heart-blood of the nation. This is the reward these men are receiving for converting the wilderness into fruitful fields, for making possible the building of homesteads and school houses and churches where desolation formerly held unbroken sway, for providing the communications that led to the building of cities and the peopling of States; whose enterprise converted untold masses of buried treasure into market value, and converted millions of forest trees from embarrassing incumbrances into valuable property.

The property value of the railways in the United States is next in magnitude to the farms of the nation, which represent the most important item of the country's wealth, and is only about one-thirteenth less. The value of our 180,000 miles of railroads is equal to about twice the capital invested in all the manufacturing establishments in the land; yet the men who misrule most of our States never tire of persecuting railroad interests while pretending to befriend all other forms of enterprise. For years the air has been burdened with lamentations of the condition of the poor farmer, and all political parties have vied with each other in scheming methods of relief. For the last four years the depression in business has closed up many manufacturing establishments and curtailed the output of others, so that thousands of willing hands have remained in involuntary idleness. The condition of this department of industry has excited the sympathetic attention of all kinds of politicians, and earnest efforts are making to pass laws calculated to put the idle wheels again in motion. This is highly commendable, and is in striking contrast with the treatment accorded to railroad property. The farmer and the manufacturer have endured the prick of hard times, but they have secured more on their investments than railroad stockholders have received on theirs, and yet the policy of legislation continues to be directed to the taking away from owners of railroad property the small returns that are left. Instead of devising means of relief for the second industry in the country, which is prostrated in the dust, through the remuneration for work done being too close to the cost of the same, the politicians continue to find sympathetic listeners when they howl that railroad rates are too high and must be reduced.

In a very exhaustive article contributed lately to the New York "Sun," on "The Plight of the Railways," by Robert P. Porter, the famous statistician, figures are given to show that the railway rates for passengers and freight have steadily decreased since 1887, till in 1895 the average charge per mile for passengers was 2.04 cents, and for freight .839 of one cent per ton per mile. The loss to railroad companies through the cutting-down of rates between 1887 and 1895 aggregated $150,000,000. The rates are much lower than those charged by the railways in Europe, although the wages paid to employés here are about twice what they are abroad; and all sorts of supplies used by railroad companies are proportionately higher. The direct effect of this has been that 70 per cent. of the railroad stock and 17 per cent. of the bonds paid no dividend whatever in 1895. The railroads as a whole must have done worse in 1896, although the figures are not yet compiled. In testimony given before the Interstate Commerce Commission Committee of the Senate, George C. Blanchard said that, had our railroads collected rates equal to the lowest of the European charges, they would have received in 1892 $370,000,000 more than they got. The increase would have been greater in 1896.

When employers of labor of any kind are not prosperous, their bad fortune reacts directly upon the employed. Our demagogues believe that in attacking railroad interests they are wreaking their wrath upon certain wealthy men who are supposed to have their abode in Wall street; but the victims who receive the hardest of the blows are the men employed by railroad companies. Before the panic there were about 875,000 persons employed directly by railroads, and it is not an extravagant estimate to say that there were 200,000 more persons employed in the manufacture of machinery and supplies used by railroad companies. The depression in business and the low rates compelled railroad companies to suspend all work that could be left undone, and to purchase nothing that was not absolutely necessary, with the result that very soon over 100,000 men were thrown out of employment, and those who remained at work were working short time and receiving less pay. The loss of work in depending industries, such as car and locomotive works, was undoubtedly greater in proportion.

Nearly all the industries on this continent have been going through the miserable cheapening process during the last two decades, but none of them have suffered so much as railroad rates. The promised return to business prosperity is delayed by the inability of railroad companies to do the necessary work upon their property, and to purchase the supplies many of them stand so greatly in need of. Yet in the face of this, many States are ringing with threats, that are by no means idle, to force down railroad rates still lower, which means bankruptcy for the companies struck, and increase of suffering among their employés. It is high time that the anti-railroad politicians were led to understand that their revolutionary policy of trying to confiscate railroad property does not affect the rich men of the East so cruelly as it afflicts the railroad mechanics and trainmen, who may be their own neighbors and political supporters.

Noticing Things.

There is an amusing story going the rounds at present, of a professor of chemistry who wanted to give his class an object lesson in the habit of observation. He put an obnoxious liquid into a glass, and dipping his finger in it he said: "This mixture is so and so," and put a finger to his lips, apparently to taste the liquid. He handed the glass around the class, and each boy dipped his finger in the mixture and put the same finger to his lips, and acknowledged that it was the stuff the professor said it was. When it came back to him he said: "Now, boys I want to show how careless you were in looking at what I did. I dipped my forefinger into the mixture, but I put my next finger to my lips; none of you were sharp enough to notice this." That is a rather odd way of teaching, but it is in a line which ought to be much more thoroughly followed than what it is, especially for students in lines where acute observation is necessary to insure success.

In chemistry and other sciences, men have made fortunes by the keenness of observation, that enabled them to see the logic of phenomena which no others had been able to notice. Keenness of observation is a great aid to success in every mechanical calling, and it ought to be assiduously cultivated.

Some persons have the natural faculty of catching on to the details of everything they look at, while others see merely the general outlines. A person who cannot see details is not likely to make a success in mechanical work, unless he cultivates the faculty, which is an easy matter if begun in time and pursued persistently. The faculty of noticing every detail is of very great use to men in charge of mechanical work, and also to those who have the care of machinery in hand. Some locomotive engineers will go around their engines, and see the condition of every nut, bolt and bearing at a glance; while other men, to learn the condition of their engines, must go laboriously over every detail, looking at every part separately. The man who is deficient in ability to see things quickly should practice going around his engine frequently and trying to remember how many things he saw at a glance. If this is done persistently, he will soon become as expert at finding out the condition of his engine as the man who has higher natural ability to do the same thing.

Writing on this subject, one of our exchanges says: "A young man was boring a small cylinder that had one head cast in—the front head. He bored it on a horizontal boring mill and ran a boring bar through the stuffing box, which had been previously bored. When it was done, it was taken to the bed plate and an attempt was made to put in the piston, but it would not go in. After fussing with it for a time, the workman called the foreman and directed his attention to the bad work by the cylinder borer. The man, putting the engine together, said that the bore was not true, and that was why the piston would not go in. Another workman looked at what they were doing, and pulled out a gland that was stuck in the stuffing box, and the piston went in all right; but it was found that the gland had been bored out of true, so that the piston would not enter. A foreman of acute observing habit would have seen at a glance what was the matter and prevented delay with the work. Similar cases are occurring every day, and it is a very expensive practice to employ a foreman who does not possess the faculty of seeing things quickly."

There are many things which pass for mysteries in the manufacture and operating of machinery, that would be made plain enough if the men in charge had only the faculty of seeing things very clearly. We remember one case where the faculty of seeing a small thing, and reasoning from small to great, overcame what for a few weeks was a troublesome mystery. A locomotive came out of the back shop and in due course was put into service on a passenger train, and every time she came in, the report was made that the engine would not steam. The usual remedies were tried without success, and orders were given to take the engine off the passenger train, as delays from want of steam were too frequent to be tolerated. There had been no material change made on the engine when she was under repairs; she had the same boiler, same cylinders, same size of draft appliances, and there seemed to be no reason why she should not steam as freely as she did before going into the shop; but the same engineer and fireman were unable to make time with her. All sorts of adjustments and draft appliances were tried without success. One day the roundhouse foreman was looking at the engine, groaning in spirit over his want of success in getting her to steam. While standing in pensive mood, his eyes lit on the guides, and he noticed that the crosshead traveled considerably short of the space permitted by the guides. An idea struck him, and he told the machinist to disconnect the crosshead and find the striking points. When this was done, it was found that the engine had more than an inch clearance at each end. When she was in the shop, much thinner pistons than those formerly used had been put in, and nothing was done to take up the extra clearance caused by the changing. The engine became a bad steamer because the cylinders were wasting a large proportion of the boiler's production to fill the empty spaces. When new cylinder heads, made to take up the clearance, were put in, there was no more difficulty in getting the engine to steam freely.

Keeping Out of Difficulties.

There is a tendency among railroad men to praise the fellow who displays unusual aptness in getting out of troublesome scrapes; but very few sing the praises of the man who never gets into any difficulties. People ought to have a good word to say occasionally for the class of men who never need to display ingenuity in dealing with difficulties that they try to avoid. The man who always attends to his engine properly, and sees that the bolts and nuts are kept tight, and that the machine is properly oiled, or that water does not get into the cylinders, ought to receive a little more consideration than the man who lets the bolts and nuts get loose, the bearings get dried, and then at the last moment works in some brilliant scheme to save a general smash-up. The man who lets the cylinder head get knocked out, and then ingeniously patches it so as to run the train to the end of the division, may be a good man; but he is not half the value of the man who always tries to save his cylinder head and loses no time through delays due to his own inefficiency.

The engineer who always has water enough in his boiler, who goes right along doing a good day's work, and doing it right, and never causes trouble with what he does, is very often the kind of man who receives the least consideration from his employers. He does nothing to excite attention to himself or his work. There is nothing particularly brilliant in doing the right thing about every time, and the best things, when they become commonplace, are not always appreciated. There is occasionally a good deal more than there ought to be in being brilliant, and a good deal less than there ought to be in being commonplace.

BOOK REVIEWS.

"Power Distribution for Electric Railroads." By Louis Bell, Ph.D. New York Street Railway Publishing Company. Price $2.50. 268 pages; 6 x 9 inches.

The principles and practices involved in the distribution of electric power for traction purposes are dealt with in a masterly fashion in this book. The author says that he has endeavored to set forth the general principles of the distribution of electrical energy to moving motors, to describe the methods which experience has shown to be desirable in such work, and to point out the ways in which these principles and methods can be co-ordinated in everyday practice. The art of correctly designing a system of distribution requires, more than anything else, skilled judgment and infinite finesse. It cannot be reduced to formulæ in which these forms do not enter as variables. The most that can be done is to sketch the lines of thought that, followed cautiously and shrewdly, lead to good results. Starting out with these ideas, he appears to have worked them out very successfully, and the book contains a wonderful volume of useful information for those connected with power distribution for electric railroads. The work is divided into nine chapters, and its scope may be judged from the names given, which are: Fundamental Principles; The Return Circuit; Direct Feeding Systems; Special Methods of Distribution; Sub-stations; Transmission of Power for Sub-stations; Alternating Motors for Railway Work; Interurban and Cross-country Work; Fast and Heavy Railway Service.

"Electricity Up to Date, for Light, Power and Traction." By John B. Verity. Fred. Warne & Co., London and New York. Price $1.

This book, which is 5 x 7½ inches and contains 238 pages, tells in a very simple and interesting manner the story of how electrical science has grown up, and what the world is doing with electricity to-day in the various arts and sciences. The work is thoroughly practical in every respect, and there is nothing in it that a novice cannot understand. The principal subjects treated are the application of electricity for lighting purposes and its application in the transmission of power. Details of both methods are given in a very intelligent form, which will make the book a very convenient work of reference for men connected with the application of electricity to practical purposes. This is the fifth edition of the book, enlarged, 20,000 copies having been disposed of in the previous editions. That shows the popularity of the book, which seems to us thoroughly deserved.

"Sketches in Crude Oil; Some Accidents and Incidents of the Petroleum Development in All Parts of the Globe." By John J. McLaurin, Harrisburg, Pa. Published by the Author.

This book has been sent to us with the compliments of Hon. Charles Miller, President of the Galena Oil Works, Franklin, Pa., to whom the book is dedicated. It is a wonderfully interesting book, telling the story of the development of the petroleum business in this country, and constitutes a comprehensive history of the discovery of mineral oil, how the industry was developed, and the men connected with its development. Many of the incidents and records of personal experience read like romances, and it seems to us that there have been more extraordinary and romantic incidents connected with the development of the petroleum business than with any other industry which the world has known. To tell what the book contains would require more space than we can give it, for every page seems to contain records of personal incidents which must be read to be appreciated. The author says that the purpose of the book is to give the busy outside world, by anecdote and incident and brief narration, a glimpse of the grandest industry of the ages, and of the men chiefly responsible for its origin and growth. He has carried out his purpose to perfection, and has produced a monument to the heroes of the petroleum industry, which is a master work of its kind. The book is profusely illustrated, with the scenes of the most important oil-producing centers, and portraits of the leaders of this industry, forming the principal subjects.

"The Mechanical Engineering of Power Plants." By Frederic Remsen Hutton, E.M., Ph.D., Professor of Mechanical Engineering in the School of Engineering of Columbia University. New York: John Wiley & Sons. 6 x 9; 525 pages. Price $5.

This is a remarkably comprehensive book, and tells nearly everything that an engineer needs to know concerning power plants. It is profusely illustrated, and is of a very practical character. The purpose of the author, in preparing this book, was to provide a text-book for the University work, and the purpose has been very well carried out. Professor Hutton believes that the most enthusiastic engineering students are those who have had practical experience in the shop or in the power house, and this book has been prepared in such a way that, by its study, a student will secure a great deal of the practical information usually obtained in actual experience. The author believes in giving as much practical experience as possible at the beginning of a course, and says that, "if the beginning of the course is made with general principles and fundamental theories, and their application made to come afterwards in an apparently secondary relation to the principles, a habit of mind is engendered which is dangerous to a wise application of theory to practice in early professional life. The temptation is to make practice square with the rational or transcendental department of theory, rather than to see in every illustration of successful practice the application of a sound theory which took account both of the experimental and the rational practice. May not this be one reason why inexperienced graduates have disappointed, in the past, both themselves and those who have sought to use and employ them? Their school training, from its point of view, had unfitted them for the point of view which in life they must occupy. It is the case that in most departments of learning other than engineering, the method which has been found most satisfactory is the rise from the concrete and the object to the abstract and the principle." That seems to us to be very sensible reasoning, and the whole of the work has been arranged to meet the practical conditions which the author advocates.

We have received the thirty-eighth annual report of the Railroad Commissioners of the State of Maine, which is a volume of 383 pages, and contains a great variety of information concerning the railroads in the State named. From the report, we find that there were 718½ miles of steam railroads operated in Maine during the last year, and that they had been more prosperous than they were the year previously. There had been a mileage increase of 5.34 per cent., and an increase of earnings of 6.75 per cent. The report is got out in first-class shape, and consists mostly of statistics and tables of figures, which do not constitute very alluring reading.

We have to acknowledge the receipt of the "Locomotive Firemen's Magazine" for 1896 in bound form. It makes a very handsome volume and contains a great deal of interesting reading matter. The improvements that have been effected on the "Firemen's Magazine" during the last year are very apparent from an examination of this volume. The editors and publishers are to be congratulated on the great improvement effected in the magazine; the improvements in the department of illustration are particularly noticeable.

We have received the proceedings of the fourth annual convention of the National Railroad Blacksmiths' Association, which was held at Chicago in September last. It is a volume of 154 pages and supposed to be of the standard size, although it is considerably off. The volume is got up in very good shape, and reflects credit on the secretary, Mr. G. F. Hinkens, of Gladstone, Minn. We advise all intelligent blacksmiths to send for this report, for they will find that it contains much interesting and valuable reading for the craft.

Among recent publications received in this office is the annual report of the New England Roadmasters' Association. It contains 119 pages of reading matter, besides a lot of advertising. The reading matter is all about track and frogs and switches and track tools and subjects of a similar character. It will be found interesting and useful reading to those engaged in track work. Copies of the report can be obtained from Mr. F. C. Stowell, Boston & Maine Railroad, Ware, Mass.

Joy's Valve Gear.

In the course of a private letter to the editor, Mr. John A. F. Aspinall, chief engineer of the Lancashire & Yorkshire, of England, contends that Mr. Clement E. Stretton did not represent fairly the opinions of British engineers in the letter which he wrote for our January number, about Joy's valve gear.

Mr. Aspinall says: "Joy's valve gear has, so far as important experience goes, done nothing to earn a bad name, if it is well designed and fitted, and as I have 450 engines with this gear at work daily, I have some chance of observing its merits and demerits.

"If it were so bad as is painted, why should Mr. Webb, of the London & Northwestern, have recently applied a number of goods engines, 18 x 24, with Joy's gear, because of the success of the former lot?"

The subject of slipping of driving wheels after the steam has been shut off, which has been so often discussed in our columns, has reached British locomotive engineers for the first time, and they are discussing it with as much earnestness as was displayed by our correspondents. There is great diversity of opinion about the cause, and some scepticism as to the phenomenon ever really happening. Those in Britain who believe that the driving wheels of some engines slip after the steam is shut off, reason that it is caused by excess of counterbalance, just as Mr. Wilson Eddy reasoned in our columns. Many of our correspondents believe that the defect is due to the engines being out of quarter, or having a bent axle; but that theory has not been advanced by any of the foreign correspondents.

A circular, issued by Mr. George F. Evans, general manager of the Maine Central Railroad, intimates to the operating department that the Brown System of Discipline without Suspension would be introduced on the whole system. This is an important addition to the railroads which have adopted the Brown system, and we are very glad to see the rapid spread that the principles founded on justice and fair dealing are making among our railroads.

In our correspondence columns appears a letter from the Cleveland Twist Drill Company, concerning a rascal who is traveling about the country, passing himself off as Mr. F. F. Prentiss, of that company. He has a fac-simile of Mr. Prentiss' card, and is using that to defraud hotel proprietors. He may have the cards of other business firms besides that, and using them for the same purpose. We advise our friends to look out for him.

A certain portion of the railroad men in New York State are very much disgusted at the acts of the present Governor Black, of New York State, and of Ex-Governor Morton, because they have appointed political hacks as railroad commissioners, instead of practical railroad men. The excitement against the two governors on this account is pushed so vigorously that it may result in political changes next election.

PERSONAL.

Mr. Joseph Farrar has been appointed foreman of the machine shop of the Grand Trunk at Montreal.

Mr. T. O. Skellie has been appointed industrial agent of the Central of Georgia, with office at Macon, Ga.

Mr. H. F. Forrest has been appointed manager of the Great Northwest Central, with headquarters at Brandon, Man.

Mr. W. Bertolet has been appointed superintendent of the Perkiomen Railroad, a branch of the Philadelphia & Reading.

Mr. R. E. Smith has been appointed superintendent of motive power of the Atlantic Coast Line, with headquarters at Wilmington, N. C.

On January 1st Robert Patterson was appointed master mechanic of the Florence & Cripple Creek Railroad. Headquarters at Florence, Col.

Mr. George D. Pratt has been appointed assistant to Mr. W. H. Baldwin, Jr., the president of the Long Island, with office at Long Island City, N. Y.

Mr. W. D. Robb, who has been for some years general foreman of the Grand Trunk Railway shops at Belleville, has been promoted to be master mechanic at London, Ont.

Mr. W. D. Trump has been appointed acting superintendent of the Flint & Pere Marquette Railroad, with headquarters at Saginaw, Mich., to succeed Mr. W. F. Potter.

Mr. J. A. Miller has been appointed purchasing agent of the Ann Arbor Railroad. He has been for several years past private secretary to General Manager Ashley.

Mr. R. W. Moore has been appointed division master mechanic of the Pittsburg division of the Baltimore & Ohio, with headquarters at Glenwood, Pa., vice Mr. Thomas Trezise.

Mr. Harry Lyddon, for some years past the chief draftsman of the machinery department of the Northern Pacific Railway at Brainerd, Minn., has been appointed general foreman of the shops at Mandan, N. D.

Mr. John P. Shafer, of Dunmore, Pa., has shown us a pass of the Michigan Southern & Indiana Railroad, given him as a machinist in March, 1857. Mr. Shafer cannot pose as a boy and show us such pioneer evidence as this.

Mr. E. A. Gould, superintendent of the Wabash's Eastern division, has assumed charge of the locomotive department. He will employ and dismiss engineers and firemen. Heretofore this department has been under the master mechanic.

Mr. N. S. Meldrum has been appointed general manager of the recently reorganized Houston, East & West Texas. Mr. Meldrum has been in Texas for the last four years and connected with the road in various capacities for some time.

Mr. F. L. Wanklyn has resigned as master mechanic of the Grand Trunk at Montreal to become general manager of the Toronto Railway, and Mr. William Aird has been appointed acting master mechanic in charge of the Montreal shops.

Mr. D. H. Albert has resigned the position of general foreman of the Chicago & Western Indiana Railroad and the Belt Railway Company, having been with the company six years. Was formerly with the Hannibal & St. Joseph at Hannibal.

Mr. Joseph Spragge, the traveling engineer of the Ontario and Quebec division of the Canadian Pacific Railway, has been transferred to the Atlantic division, and promoted to the position of master mechanic, with headquarters at McAdam Junction, N. B.

Mr. W. W. Smith has been appointed by Governor Pingree, of Mich., to the office of State mechanical engineer. Mr. Smith has been for many years an engineer on the Michigan Central, and for several years back has run the famous express engine No. 512.

Mr. E. C. Allen has been appointed chief train dispatcher of the First and Second divisions of the Erie, with headquarters at Meadville, Pa. He succeeds Mr. J. S. Matson, who goes to the Pittsburgh, Bessemer & Lake Erie as superintendent of transportation.

Mr. George A. Schmoll, a mechanic in the shops of the Pittsburg, Fort Wayne & Chicago at Fort Wayne, has been appointed general foreman of the company's shops at Crestline, O. Mr. Schmoll entered the services of the company at Fort Wayne in 1881 as an apprentice.

A change in officials of the Northern Pacific which has just been reported, is that of Mr. E. J. Schwellenbach who, it is said, will leave the position of agent at Superior to become assistant superintendent of transportation. Mr. Schwellenbach has always been in the employ of the Northern Pacific, having at one time been inspector at Jamestown, N. D.

Mr. S. Yamaguchi, a Japanese engineer, has been visiting this country for several months on behalf of Mitsui & Co., Tokio, Japan. He has been looking into all lines of engineering work and expects to order considerable machinery after his return. Mr. Yamaguchi was educated at the Lehigh University, Bethlehem, and remained there for eight years, taking a post-graduate course in civil engineering.

Mr. George Lasham, an old locomotive inspector, who retired recently from service on the London & Southwestern Railway, was presented by Queen Victoria with a handsome silver salver, on the occasion of his retirement from active service. He had been in the habit of running the Queen's train, and made while in service 155 trips from London to Osborne and back with that important train.

Mr. J. W. Fitzgibbon, who has been for several years master mechanic in charge of the Chicago, Rock Island & Pacific shops at Chicago, has been appointed assistant superintendent of motive power and equipment, in charge of locomotive and car departments of the lines west of the Missouri river, with headquarters at Horton, Kan. He succeeds Mr. H. Monkhouse, who has gone to the Chicago & Alton.

At the second annual convention of the Association of Manufacturers, held in Philadelphia last month, Mr. C. F. Quincy, of the Q. & C. Co., was elected vice-president. Among other railroad supply men who took a prominent part in the proceedings were: Mr. J. H. Converse, of the Baldwin Locomotive Works; C. H. Moore, of Manning, Maxwell & Moore; Mr. Egan, of J. A. Fay & Co. Mr. M. E. Ingalls, president of the Cleveland, Cincinnati, Chicago & St. Louis, gave an address at the meeting.

Mr. John Player, superintendent of motive power of the Atchison, Topeka & Santa Fé, writes us: In making the change with Mr. Hancock, bringing him from the Gulf Line to Topeka, some other changes occurred among Santa Fé master mechanics: Mr. James Collinson, of the Chicago division, succeeds Mr. Hancock at Galveston; Thomas Paxton, of the Middle division, succeeds Mr. Collinson at Ft. Madison, and Mr. J. E. Gavitt, who has been roundhouse foreman at Newton for a long time, promoted to succeed Mr. Paxton.

Mr. David Kirkaldy, who was the originator of the present system of testing engineering material, died in Scotland a month ago. Mr. Kirkaldy was born in Dundee, Scotland, in 1820, and learned the machinist trade in one of the principal ship-building works in Glasgow. His attention was early devoted to the necessity for devising methods of testing material, and he worked out the principles of the machines by which testing was done in early days. Of late years he devoted himself to the business of testing material, and made quite a success of that industry.

Mr. Russel Harding has been appointed general superintendent of the Great Northern, with headquarters at St. Paul, Minn., in place of Mr. J. M. Barr, resigned, and will have full charge of the operation of all the company's lines. Mr. Harding went to the Great Northern September 1, 1894, as superintendent of the Dakota division. He was appointed general superintendent of the Western district at Spokane, Wash., in March, 1896, and in July of the same year was given the title of assistant general superintendent of the entire system, with headquarters at Spokane.

Mr. James M. Barr has resigned as general superintendent of the Great Northern, effective February 15th, to accept the position of vice-president of the Norfolk & Western, with headquarters at Roanoke, Va. He went to the Great Northern September 1, 1894, as superintendent of the Breckenridge division. In January, 1895, he was appointed general superintendent of the Eastern division, and on July 20, 1896, was made general superintendent of the entire system and assumed the duties formerly performed by the general manager. Before going to the Great Northern he was for four years superintendent of the Chicago & Council Bluffs and Chicago & Evanston divisions of the Chicago, Milwaukee & St. Paul, and he was formerly for several years superintendent on the Union Pacific.

Many of the readers of "Locomotive Engineering" will remember A. T. Calkins, a former engineer on the Burlington, Cedar Rapids & Northern, with which company he remained from 1872 to 1885, enjoying the respect and esteem of both officials and employés of the road. Mr. Calkins, or "Dell," as the boys call him, quit railroading and went to Iowa City, where his shrewd business tact manifested itself in material results. Mr. Calkins is now president, treasurer and manager of the Republican Printing Company, proprietors of the Iowa City daily and weekly "Republican," which papers are the leading publications of Johnson County, Ia. Mr. Calkins has demonstrated in this new enterprise the success that may come to him who eternally perseveres. While business cares engage him very closely, he still has a warm spot for old railroad men, and his office is always found to contain a standing and hearty welcome to all.

George Royal.

In the death of George Royal, which happened at his home at Oak Park, Ill., last month, the railway supply fraternity loses one of its best-known members, and a host of railroad men have lost a warm friend. Mr. Royal was essentially a man of peace, and his favorite work was in trying to harmonize discording interests. When trouble arose or was brewing between railroad men and their employers, it was Mr. Royal's pleasure to step in and get the parties in dispute to reason together.

George Royal was born at Manchester, England, in 1837, and early in life went to work in the engine room of a cotton factory. He came to this country in 1863 and went to work in the shops of the Central Railroad of New Jersey, at Elizabethport, N. J. Then he ran an engine on the Delaware, Lackawanna & Western for a time, and afterward was on the Erie, and left that to go to the Central Pacific. Shortly after entering the service of that company as an engineer, he was promoted to be superintendent and master mechanic of a mountain division. There he interested himself in trying to spread religious influence among the ungodly denizens of the district, and on account of his labors in this work, he was ordained a minister of the Baptist Church. He gave up his position on the Central Pacific to enter the service of the Nathan Manufacturing Company, and remained with them till the day of his death.

GEORGE ROYAL.

Mr. Royal was a natural orator, and his eloquence had a powerful influence on the audiences of railroad men and others which he frequently addressed. It will be a comfort for those he has left behind to reflect that his burning words were always uttered in the interests of peace.

Mr. Sanford Keeler has been appointed to represent the Nathan Manufacturing Company, in Chicago, taking the place of the late Mr. George Royal. Mr. Keeler was long identified with the Flint & Pere Marquette Railroad and other important railway interests in the Northwest.

Mr. George B. Roberts, for many years president of the Pennsylvania Railroad, died on the 30th day of January, after an official career with the company, comprising practically the whole of his business life.

EQUIPMENT NOTES.

The Northern Pacific Railway are building 100 flat cars at their own shops.

The Milton Car Works, Milton, Pa., are engaged on an order for 50 tank cars.

The Wells & French Company are to build 500 refrigerator cars for the Armour Company.

The United States Car Company are repairing 200 cars of the Commerce Despatch Line.

Thirty freight cars are under construction at the St. Charles Car Works for the Wabash Railroad.

It is understood that the Missouri Pacific Railway are to build 100 freight cars at their own shops.

It is said that the Mexican Central Railway will, in the near future, place an order for 100 freight cars.

The Indiana Pipe Line Company have placed an order for 25 cars with the Wells & French Company.

The Pullman Car Company are building 100 cars for the San Antonio & Aransas Pass Railway.

The Arizona & New Mexico Railway are bettering their equipment to the extent of 10 new box cars.

The St. Charles Car Company are building 50 box cars for the Union Pacific, Denver & Gulf Railway.

The Cleveland Provision Company are

having 25 refrigerator cars built by the Wells & French Company.

The Lehigh & New England Railroad are having two locomotives built at the Rogers Locomotive Works.

The Ferro Carril Nacional Central Railway are having six locomotives built at Rogers Locomotive Works.

Fifty freight cars are being built by the Pullman Car Company for the San Francisco & San Joaquin Railway.

The Barney & Smith Car Company are building 100 60,000-pound box cars for the Kansas City, Pittsburgh & Gulf.

The Northern Pacific Railway have ordered 150 flat cars to be built at the Michigan-Peninsular Car Works.

The Haskell & Barker Car Company are building 1,000 freight cars for the Chicago & Northwestern Railroad.

The Baldwin Locomotive Works are building two locomotives for the Vicksburg, Shreveport & Pacific Railroad.

Davis Bros. & Hartmann, of Philadelphia, are to build six 10-ton liquid cinder cars for the Bethlehem Iron Company.

The Missouri Pacific Railway have placed an order with the Missouri Car & Foundry Company for 36 freight cars.

Two new engines, built by the Schenectady Locomotive Works, have been delivered to the Texas Midland Railway.

The Kansas City, Pittsburgh & Gulf Railroad are having four locomotives built at the Baldwin Locomotive Works.

The Brooks Locomotive Works have begun shipment of the locomotives built to the order of the Mexican Central Railway.

The Cleveland, Cincinnati, Chicago & St. Louis Railway have just completed two locomotives at their Bellefontaine shops.

The Richmond Locomotive Works have an order for six locomotive boilers for the International & Great Northern Railway.

The Ohio Falls Manufacturing Company are about to build two passenger cars for the Lookout Incline & Lulu Lake Railway.

It is understood that the Chicago & Eastern Illinois Railroad will place an order for several hundred freight cars in the near future.

The Pullman Palace Car Company have delivered 4 of the order for 12 new sleeping cars made some time ago by the Pennsylvania Railroad.

The Penn Gas & Coal Company, of Philadelphia, have ordered 50 gondola cars from the Carlisle Manufacturing Company, of Carlisle, Pa.

The Ohio Falls Car Manufacturing Company have received an order for 50 platform cars from the Pittsburgh, Bessemer & Lake Erie Railroad.

The Chesapeake & Ohio are to have built at the Ensign Manufacturing Company's Works 100 hopper-bottom coal cars, of 80,000 pounds capacity.

An order was placed by an export firm for four light locomotives for plantation use. They will go to the English West Indies early in March.

There has just been completed at the Verona shops of the Allegheny Valley Railroad a new 17 x 24 engine. Several more of the same type will be built at these shops.

The American Steel Foundry Company, of St. Louis, have sold one of their American compressed-air railway ditching and wrecking cars to the Texas Midland Railroad.

The Carnegie Steel Company are in the market for a large equipment of steel hopper-bottom cars, and have invited bids on their drawings and specifications from car companies.

The Jackson & Woodin Manufacturing Company, of Berwick, Pa., have completed and delivered their order of 408 platform cars, 5 cabooses and 180 box cars for the Bangor & Aroostook Railroad.

The first compound locomotive believed to have gone from this country to Central America will be shipped on the steamer "Advance" at her next sailing. It was built by the Pittsburg Locomotive Works.

The Brooks Locomotive Works will soon be ready to deliver five 10-wheel passenger engines for the Mexican Central Railroad. The Pullman Company recently received an order from the same road for thirty cars.

The Schoen Pressed Steel Company are furnishing their diamond pressed-steel bolsters for body and trucks of the Fairport Elevator Company, for their cars now building at the shops of the Missouri Car & Foundry Company.

The Kansas City, Pittsburgh & Gulf Railroad are having 3 trains of vestibule cars built by the Barney & Smith Company, of Dayton, O. Each train will consist of one baggage car, one passenger coach and one reclining chair car.

The Southern Pacific Railway are about to put on 5 new postal cars between New Orleans and Houston. It is the design of this company to put in shape their present old postal equipment and refit them with the best modern appliances for postal service.

The largest order for railway engines given in some time was received last month by the Richmond Locomotive Works, from the Charleston & Western Carolina Railway Company. It was for ten engines, with an option for an additional number.

The Gold Car Heating Company, New York, received orders during one single week in February for the heating apparatus and equipment of 750 passenger cars for England. Since that date additional orders have been taken for same equipment for 450 more cars, also for England.

The Kansas City, Pittsburg & Gulf Railroad have just finished specifications for 27 new engines, some of which will be Baldwin and a part Manchester. Further equipment consisting of 500 new box cars and ten new coaches from the Baring & Smith Company are just arriving. Two new Manchester passenger engines, with 18 x 24 cylinders and 68-inch wheels, and weighing 112,000 pounds, have been received and are in service.

A New York export firm interested in the Pekin (China) Railroad, which is at present under construction, has been advised that the line will be completed to that city early in the spring. The road will be about 80 miles in length, and its entire expense is estimated at about $9,740,000. The Baldwin Locomotive Works, they say, have received a contract for eight locomotives for this road, their bid having been $2,922 cheaper than the lowest English tender.

The Sargent Co., Chicago, write us: "We have to report a heavy trade in our patented steel and iron brake shoes for the first month of the year, also a large increase in plain and Congdon brake shoes, most of the large systems centering in Chicago having begun to order freely on their 1897 contracts. In our open-hearth steel department, locomotive and car castings form a much larger proportion of our work than at any previous time, we having in the sand at present twelve wheel centers, in addition to deck and center plates, piston heads, followers, crossheads, driving boxes, bolsters, rocker arms, etc. A constantly growing number of new customers shows in a gratifying manner the victory of steel over wrought and gray iron for railroad work."

In talking of his success as an inventor, Edison said that he attributed much of it to the fact that he knew about so many mechanical things that won't work. He also expressed the belief that he had exhausted the possibilities of making mistakes.

There is an unmistakably healthy beat in the pulse of the car-building industries just at this time. Orders are being placed for equipment that must be had if business is to be transacted.

An Italian Railroad Shop.

[EDITORIAL CORRESPONDENCE.]

To the tourist looking for interesting sights in the way of antiquities, art work and beautifully decorated churches, Turin is one of the most attractive cities to be found anywhere. I saw as much of the general attractions as I could find time for, but the greatest part of my attention was devoted to the engineering establishments of the Italiana delle Strade Ferrate del Mediterraneo, the long name of the Mediterranean Railway.

As a rule, there is considerable difficulty in obtaining permission to visit railway workshops on the Continent of Europe, unless one is acquainted with some of the officials or has letters of introduction. I had neither acquaintance nor letters to the Mediterranean people, but I determined to depend upon my own persuasive powers, so I took a cab and went to the office of the Chief Engineer, who holds the same position as our superintendent of motive power. The sanctum was reached with remarkably little obstruction, and Mr. C. Frescot, the chief engineer, a pleasant-faced, venerable-looking gentleman, came out with my card in his hand and received me very cordially. He knew both "Locomotive Engineering" and the "American Machinist," and was glad to welcome the representative of these journals. Like many other foreign engineers, he reads English, but does not talk it. He talked French, however, as fluently as a native, and I managed to keep up a conversation with him for about twenty minutes. He was very much interested in American railway machinery, and asked a great many questions about our engines, cars and the gradients that our trains had to be worked over.

He was perfectly agreeable that I should visit his shops. In the office of Traffic Inspector Mandolini there is a man, Louis Turo, who talks English. Mr. Frescot expressed regrets that he could not go with me to the shops, but he got the English-speaking official to accompany me, an act of kindness which proved highly serviceable, for the different shop superintendents talked nothing but Italian, which I do not understand.

The shops are in the suburbs of the city and are very extensive. The carriage and wagon shop, where all kinds of cars are built and repaired, is 100 x 160 meters, or about 325 x 520 feet. This shop is single-story and has nine roofs supported by pillars. They are all formed of light-looking steel girders and a considerable part of the covering is glass. They build and repair about 9,000 cars a year, but they are small affairs compared to our cars. The locomotive erecting shop is about 500 feet long and 300 feet wide. The engines and tenders undergoing repairs stand side by side, as in the ordinary American erecting shop, and there are two rows of stalls, one at each side of the building. There is a transfer table that moves along the middle of the shop, between the rows of stalls, and not only takes in the engines and tenders, but conveys many of the heavier parts to and from the erecting shop. The latter is built at right angles to the erecting shop, and very good facilities have been provided for the transportation of material between that and the various other shops.

The machine shop is remarkably well provided with first-class tools, and the others with cranes and facilities for handling material. Nearly all work is done on the piece-work system, but it does not seem to stimulate rapidity of production nearly so much as it does with us. The work turned out is excellent, most of it being finished with great care, but there seems to be no spirit of push in any of the shops. The tools run slow, and take light cuts and the workmen are deliberate in their movements. The sentiment pervading all European workmen to go slow is particularly noticeable in the Southern countries. We hear a great deal about our workmen having to compete with the cheap labor of Europe, but I have never seen a manufacturing establishment where the labor is so cheap as it is in America when the amount of production is taken into account.

There are 1,800 men in these shops, and they repair 200 locomotives and 9,000 cars a year. The cars are nearly all small four-wheel "wagons," with a capacity varying from 4 to 10 tons. The locomotives are nearly all four-wheel connected with single pair of leading wheels, or six wheel connected with no other wheels. There are a few eight-wheelers with four-wheel trucks, and some of what might be called consolidation engines without a pony truck are used for mountain service. One of these engines, that was undergoing a general repair, had cylinders 23 x 26 inches. The steam ports of this engine are 13 inches long by about 1¼ inches wide and the travel of valve is less than 5 inches.

What struck me as peculiar in the shop was the number of wheel lathes. I counted nine large lathes for driving wheels and four for smaller wheels. The foreman told me that there were ten others for turning car wheels. The amount of tire turning called for by cars is not surprising, for it is very rarely that a train stop is made without having most of the wheels sliding. But this bad practice is not confined to Italian railways. It prevails all over Europe. No careful work seems to have been done towards harmonizing the braking power with the adhesive weight.

Another striking thing is the extent and the thoroughness of the work done on boilers. There are over 1,300 locomotives on the system and the road is one of the first built in Italy, yet they never have had but one boiler explosion. The boilers are nearly all small, of our ordinary deep firebox type, and most of them are straight, about 48 inches diameter. In ordinary service the boilers are all closely inspected at short intervals, and pressure tests made frequently. When an engine goes into the shop for repairs, what we would consider an extraordinarily rigid inspection is made to discover any lurking defects or weakness, and thorough repairs are effected. The boiler shells of recent build are all steel; the fireboxes are all copper, and the tubes brass. The feed water in this region appears to be quite free from mineral impurities, for I saw very little scale about the boilers.

The shops and the rolling stock reflect faithfully good forms and practice, as found on all first-class European railways. There is no pressure of anti-railway sentiment to cut down earnings below a fair wage and dividend paying basis, and so the companies are not stimulated to extraordinary measures of economy. They keep up their track and rolling stock in first-class order all the time, and there seems no desire for labor-saving methods.

Until a few years ago they were satisfied to duplicate the earlier forms of rolling stock, but they are now moving in the direction of heavy engines and vestibule cars. American railway men visiting Turin will find a visit to these shops interesting, but they are not liable to see any tools or practices which they wish to carry away with them.

A. S.

We have received the annual catalog, 1896-1897, of the Massachusetts Institute of Technology, Boston. The volume gives a great variety of particulars about the admirable technical establishment named, and gives detailed information relating to the various courses of scientific education carried on in the establishment. The various departments of engineering occupy a prominent place, as they have a right to do, since engineering instruction is the principal work done by the Massachusetts Institute of Technology. It also contains a historical sketch, tracing the growth of the establishment from its foundation in 1861. Persons interested in the higher lines of scientific education can obtain copies of this catalog by application to H. W. Tyler, Secretary, 491 Boylston street, Boston, Mass.

William Sellers & Co., of Philadelphia, have been building two large boiler-shell drilling machines for the Sormovo Locomotive Company, of Russia, of which Mr. W. F. Dixon is chief engineer. Mr. Dixon, who has charge of the erecting and equipping of these new locomotive works, writes us: "We are getting along here pretty well; a large number of our heavy machines are in place on their foundations, and completely erected, and we are hustling all we know how to get things into shape to commence operations for locomotive building.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(14) C. F. C., Hartford, N. Y., asks:

Why could not a locomotive fire be forced, more economically and successfully, with a furnace blower geared to the axle, than with the contracted exhaust openings now in use? A.—The proposition implied in your question has been tried many times and found unsatisfactory in practice, owing to its complications. It has never been made to give results equal to properly designed nozzles. The blower was a prominent feature on our first locomotives, and comes up periodically, only to be shelved again when its sponsors learn of its antiquity.

(15) W. W. L., Philadelphia, Pa., writes:

Will you kindly explain to me, under the head of "What You Want to Know," what is the Meyer valve gear, what are its advantages over the link motion, and say if it was ever used on a locomotive? A.—The Meyer valve gear consists of an expansion valve riding on the top of a distributing valve, each of which are actuated by a separate eccentric. It has no claim to superiority over the link, and has not been in use on a locomotive in this country, to our knowledge; but a motion very similar to it, having a cut-off valve above the main valve, and riding on a seat of its own, was largely in use here during the days of the hook-motion engines. These were known as independent cut-off engines.

(16) J. W., Macon, Ga., writes:

Will you please give me a practical method for finding the length of a reach-rod without taking the travel of the valves, which is the method now employed, and while it can be very accurately done this way, it is very aggravating to take down and put up again, as the sand pipes and wheel covers are always up in place before the valves are set? A.—Make the upper rocker arm and the reverse lever stand plumb, which will be their positions when the valve is in the middle of its travel; that is, when it stands central over the ports. Connect the link-lifters to the lower reverse shaft arms and the saddle pins. The distance from the center of the hole in the upper arm of the reverse shaft to the center of the hole in the reverse lever will be the length of the reach-rod between centers of pins. For an inclined valve face, square the upper rocker arm with it and proceed as before.

(17) J. McC., Peshtigo, Wis., writes:

A tire worked loose on a driving wheel here, and to secure it, we bored holes half in the tire, and through the wheel rim, tapping the holes in the tire and rim and screwing in plugs, which gave good satisfaction and has run eight months now. I never heard of anyone doing a job on a loose tire in this way before. What do you think of this method of fastening in case a tire works loose? A.—Tires were held in the manner you set forth, more than twenty-five years ago, and it was regarded at that time, and many years after, as the correct way to handle the problem of securing tires. The wheel rims were drilled and tapped for six or eight 1¼-inch bolts, which were pointed on the ends at an angle of about 60 degrees, and screwed into a corresponding recess countersunk into the bore of the tire, the tire being put in place under a light shrinkage. The bolts were prevented from backing out by means of jamb nuts under the heads. All this was abandoned when it was found that tires could be held by shrinkage alone.

(18) J. H. C., Richmond, Va., writes:

I am not a subscriber to your paper, but I have read a good many numbers with much interest, and as I find, by scanning its pages, that its owners are possessed of much valuable knowledge of the locomotive and its performance, I would like, if it is not too much, to ask the following question: Take, for an example, two cylinders, each 19 x 24 inches; place them about 4 inches apart, and connect them with a pipe having a cock in it. Suppose this cock between the cylinders to be closed, and steam at 100 pounds pressure be admitted to one of the cylinders, and after having this cylinder filled with steam, shut off the supply and open the cock between the two cylinders. What I want to know is, what would be the pressure existing in both cylinders? A.—By the terms of Boyle's law, the pressure of gases varies inversely as their volumes, when kept at a constant temperature. The steam in your cylinders would expand to twice its original volume when the cock between them was opened, and, by the law quoted, the pressure in each cylinder would then be ½ x 100 pounds, or 50 pounds, but there would be a loss of pressure, owing to a lowered temperature always attending expansion, and also due to condensation. which would make the pressure something less than 50 pounds.

(19) W. P., Toronto, Can., writes:

1. Will you kindly give me the rule for finding the hyperbolic logarithm of a number, or please let me know where I can get a table of logarithms at the least cost? I am unable to use the formulas you give for finding M. E. P. and tractive force, as I don't understand how to get the hyperbolic logarithms, and I think there are many others in a similar fix. A.—All mechanical engineers' pocket books, or any work on steam, will give you the information you ask for, and we would recommend that you get either of those books, with their tables of logarithms, rather than purchase the tables alone, since the cost would be practically the same in both cases, and you would have the advantage of the additional matter in the works quoted. 2. Will you please explain how to find the M. E. P. in high and low pressure cylinders of a compound engine, without an indicator? A.—It would be useless for us to attempt an answer t this question in the space allowable for the purpose; for this reason, we refer you to books which treat on the subject clearly, such as "Compound Locomotives," by Arthur S. Woods; "The Steam Engine," by George C. V. Holmes; and also "Steam," by H. Ripper. Either of these works, if carefully studied, will be a convincing argument that knowledge is not to be obtained without effo-t. These books can be had through our book department.

(20) W. B., Sheffield, Ala., asks:

1. Does it strengthen a 6-inch axle to drill a 2-inch hole through the center of it, and if so, why? A.—A hole in the center of an axle or shaft does not give additional strength, notwithstanding there is a well-rooted belief that a void has some occult power in itself. The contrary is true, as a comparison of the moments of resistance of a solid and hollow cylindrical section, of the same outside diameter, will show. If R = moment of resistance, d the outside diameter, and d' the diameter of the hole, then R for the solid 6-inch shaft $= 0.0982 \times d^3 = 21.21$, and R for the same shaft with a 2-inch hole through it $= 0.0982 \times \left(d^3 - \frac{d'^4}{d}\right) = 20.95$.

From these figures we see that the hollow axle is slightly weaker than the solid, having 98.5 per cent. of the strength of the latter, with a saving of 11 per cent. in weight. 2. How much greater pressure will an injector work against, than the pressure in the boiler that the injector is connected with; that is, steam pipe from one boiler and branch to another? A.—The Nathan Manufacturing Company, of New York, has kindly furnished us the following data bearing on this subject: Injector worked with 180, 160 and 140 pounds, against a boiler pressure of 320, 280 and 220 pounds, respectively. 3. Why is it that a hole is drilled through steamship shafting? A.—Reply to first question covers this. 4. How much greater is pressure per square inch in the leg of a boiler than in the dome? A.—The pressure is greater by the weight of a column of water of a hight equal to that in the water leg. 5. Is there any advantage in a non-lifting injector? A.—A non-lifting injector has less work to do, since it does not lift the water; it will wear longer, as the parts are always submerged, and therefore cost less for repairs. The pipes being filled with water, the parts cannot be incrusted, nor obstructed with a baked-on scale.

Conversation Overheard Between Two Engineers at Custer Street Roundhouse.

BY J. H. GOODYEAR.

Tom—Say, Charlie, is the coal posting sheet for last month out yet?

Charlie—I guess so.

Tom—Let us go and see how we stand this month—33 per cent. over the allowance against 39 last month. Good! But, say, I never could quite understand how they work this record business out. Do you know?

Charlie—Yes; I have had it explained to me. The "old man" has gone over the river. Come into his office and I'll explain the whole business to you.

Tom—All right; go ahead.

Charlie—You understand that the records are worked out on a ton-mile basis; that is, the weight of the cars and contents multiplied by the number of miles hauled. As an example, I take train No. 82—St. Paul to Elma:

We start out with 454 tons, which we haul to South St. Paul:

	Ton-miles.
454 tons to South St. Paul. Equal to	1,362
Pick up at South St. Paul 27 tons, making 481 tons South St. Paul to Randolph .... Equal to	13,468
Pick up at Randolph 51 tons, making 532 tons Randolph to Kenyon .... Equal to	10,640
Pick up at Kenyon 47 tons, making 579 tons Kenyon to West Concord .... Equal to	5,790
Pick up at West Concord 82 tons and set out 57 tons, making 604 West Concord to Eden.. Equal to	2,416
Set out 49 tons at Eden, making 555 tons Eden to Dodge Center. .. Equal to	2,775
Set out 27 tons at Dodge Center, making 528 tons Dodge Center to Hayfield .... Equal to	4,752
Pick up 31 tons and set out 96 tons at Hayfield, making 463 tons Hayfield to Sargent.... Equal to	3,241
Pick up 259 tons at Sargent, making 722 tons Sargent to Renova. .. Equal to	3,610
Pick up 31 tons at Renova, making 753 tons Renova to Sutton .... Equal to	3,012
Pick up 30 tons at Sutton, making 783 tons Sutton to Elkton .... Equal to	1,566
Pick up 85 tons at Elkton, making 868 tons Elkton to Taopi .... Equal to	6,076
Pick up 53 tons at Taopi, making 921 tons Taopi to McIntire .... Equal to	8,289
Pick up 61 tons at McIntire, making 982 tons McIntire to Riceville .... Equal to	5,892
Pick up 52 tons at Riceville and set out 23 tons, making 1,011 tons Riceville to Lowther.. Equal to	5,055
Pick up 30 tons at Lowther, making 1,041 tons Lowther to Elma. .. Equal to	5,205
Making the total ton-mile of cars .... Equal to	83,149
Now to this they add the weight of the engine and caboose, St. Paul to Elma .... Equal to	12,870
	96,019

You notice I have made 96,019 ton-miles; the allowance for train No. 82 being 1 ton per 10,000 ton-miles.

Tom—Wait a minute; you say the allowance for No. 82 is 1 ton. How do they arrive at that?

Charlie—The allowance of coal per ton-mile of to'al train has been determined by actual tests for each direction and class of train, by divisions. I have a copy of the allowances for the entire system. Would you like to see it?

ALLOWANCE FOR COAL CONSUMPTION OF LOCOMOTIVES.

DIVISIONS.	SOUTH. Passenger. Limited.	SOUTH. Passenger. Mail & Ex.	SOUTH. Freight. Time.	SOUTH. Freight. Way.	SOUTH. Freight. Extras.	NORTH. Passenger. Limited.	NORTH. Passenger. Mail & Ex.	NORTH. Freight. Time.	NORTH. Freight. Way.	NORTH. Freight. Extras.	ROUND TRIPS. Milk.	ROUND TRIPS. Motor.	ROUND TRIPS. Sub.	ROUND TRIPS. Local.
St. Paul	1.1	1.3	.8	1.0	1.0	.9	1.2	.7	.8	1.0	1.2	1.5	...	...
Dubuque	.7	.8	.5	.6	.6	1.1	1.3	.8	1.0	1.0	...	...	...	...
Chicago, East and West	.9	1.0	.7	.8	.8	1.0	No. 5-9 1.2	.7	.8	.8	...	...	1.5	...
Des Moines	1.0	1.1	.8	.9	.9	1.0	1.1	.8	.9	.9	...	...	...	...
St. Joe & Kansas City	1.0	1.1	.8	.9	.9	1.0	1.1	.8	.9	.9	...	...	...	.9
Lyle Branch	...	...	...	...	...	...	...	...	...	...	...	...	...	1.5
Waverly Branch	...	...	...	...	...	...	...	...	...	...	...	...	...	1.0
Cedar Falls Branch	...	...	...	...	...	...	...	...	...	...	...	...	...	1.5

As I said before, the allowance for train No. 82, St. Paul division, is 1 ton per 10,000 ton-miles. This, you will notice, gives me for hauling train a coal allowance of 9.60 tons. According to the roundhouse foreman's report. I started out with 8½ tons of coal in tender, took on at Kenyon 6 tons, arriving at Elma with 1 ton in tender, making a gross consumption of 13½ tons.

Tom—But what about time idle and work we do between terminals? Do we not receive any allowance for that?

Charlie—I was just going to explain that to you. The consumption shown against one's name on coal posting sheet represents the amount it is considered was consumed in hauling trains, and to arrive at those figures, they follow each train over the division by the aid of train dispatcher sheets, and thus ascertain time idle and switching on roads. Train No. 82, for instance, was delayed as follows:

Minutes Idle.	Station.	Minutes Switching.
30	State St.	—
—	So. St. Paul	15
60	Randolph	15
15	Hampton	15
135	Kenyon	55
15	West Concord	15
20	Skyberg	—
5	Eden	15
10	Dodge Center	15
15	Hayfield	30
—	Sargent	18
—	Renova	12
—	Elkton	20
20	Taopi	10
35	McIntire	15
15	Riceville	20
20	Lowther	20
25	Elma	10
420		300

Equal to 5 hours' switching and 7 idle. Add to this 1 hour idle before coaling at Custer street, and 1 hour after coaling at Elma, makes 9 hours idle and 5 switching. For this we are allowed at the rate of 480 pounds per hour switching, and 48 pounds idle. This gives me for idle and switching on road train No. 82, a credit of 1-41 tons—deducted from roundhouse foreman's figures, leaves a net consumption of 12.09 tons, which it is considered was consumed in simply hauling train. They then deduct from the net consumption of 12.09 the allowance according to ton-mile of total train, viz., 9.60, which leaves 2.49, representing the excess over the coal allowance, and from which the percentage of excess is obtained. Each man's work during the month is classified, and the allowance made according to class of train, then added together, and the figures, as shown on posting sheet, arrived at in the same manner as I have worked out train No. 82. Do you follow me?

Tom—Yes: I understand. But there is another point: Are we allowed anything for making up time?

Charlie—I asked that question, and will tell you what they said: It is conceded that additional coal is used in making up time, and that an allowance might reasonably be made for time made up. On the other hand, it has been demonstrated that it is not always the man who makes up time who uses the most coal. You, for instance, might take a train at Elma, 1 hour late, try your utmost to make up that hour, yet, owing to adverse circumstances on your own division, not be able to make up a minute of it. Would you not use additional coal in the effort? Certainly you would; but, under the circumstances, it would be difficult to make you an allowance. It is therefore considered advisable to let each man take his own medicine.

Tom—Well, that appears reasonable enough. I see they have an additional posting sheet out. What is the object of that?

Charlie—The difference between the two sheets is this: The old one shows the coal consumed, the allowance, and excess over the allowance. The new sheet shows, in dollars and cents, the cost of coal used for each 10,000 ton-miles by each engineer, and the cost of coal wasted as compared with the best record on same class of trains. Take, for instance, way freight, St. Paul division. We will assume there were six engineers, A, B, C, D, E and F, running this class of train last month:

A made 426,445 ton-miles; consumed 61.03 tons, at the rate of 1.43 tons per 10,000 ton-miles and a cost of $2.86

B made 435,115 ton-miles; consumed 62.78 tons, at the rate of 1.44 tons per 10,000 ton-miles and a cost of 2.88

C made 465,190 ton-miles; consumed 55.56 tons, at the rate of 1.19 tons per 10,000 ton-miles and a cost of 2.38

D made 447,825 ton-miles; consumed 54.44 tons, at the rate of 1.21 tons per 10,000 ton-miles and a cost of 2.42

E made 486,277 ton-miles; consumed 78.09 tons, at the rate of 1.60 tons per 10,000 ton-miles and a cost of 3.20

F made 436,257 ton-miles; consumed 54.06 tons, at the rate of 1.23 tons per 10,000 ton-miles and a cost of 2.46

Engineer C, you will note, has the best record; the cost of his coal per 10,000 ton-miles being $2.38, less than any of the other five men. We will now see the value of coal wasted by Engineer E as compared with Engineer C:

Cost of coal per 10,000 ton-miles; Engineer E.......$3.20
Cost of coal per 10,000 ton-miles; Engineer C....... 2.38

Difference per 10,000 ton-miles......$0.82

Engineer E made 486,277 ton-miles. This, figured out at the rate of 82 cents per 10,000, gives the value of coal wasted $39.76. You will see that this method of working the consumption out shows forcibly to the men and the officials the amount wasted by certain men on the same class of train or run, as compared, *not with the allowance*, but with the best man on the runs.

Tom—You appear to be well posted on the coal business, Charlie.

Charlie—Yes; I made it a point to study

the question, for this reason: I realize that the method of accounting for coal, adopted by this company, allows a man to work somewhat on his merits. You know as well as I do, that if one of the boys gets into trouble, and there is some talk of letting him go, one of the principal things taken into consideration is his coal record. If he has a good coal record, it may save him. Now, the moral of that, to my mind, is—Get your coal record in such shape that, should you need help, it will help you. I also think the first step to take is to understand the method of working it out. That is why I studied the question some. Another thing I generally make a practice, is to see that I am getting a square deal in the way of coal on tender leaving and arriving. Ever do that?

Tom—No; did not think it cut much figure.

Charlie—That is just the way. You expect to go to the top of the list without making any effort to get there.

Tom—Wait a while. Now I have a better insight into the business, I guess I'll talk the matter over with my fireman, and maybe we will keep you "humping" in a month or two to get anywhere near us. There comes the "old man."

Old Man—Halloa, boys! What is the subject now?

Tom—Coal.

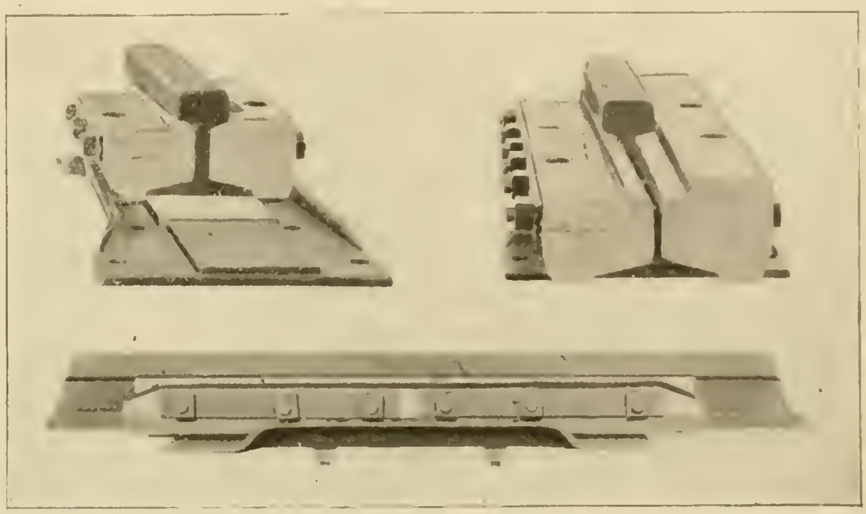
Old Man—Good subject, too—one which, in your own and the company's interest, will bear considerable talking about.

St. Paul, Minn.

An Improved Rail Joint.

The Neafie insulated joint is a truss plate, or chair of iron or steel, bent, with sides inclined upwardly; upon this plate rest the abutting ends of two adjacent rails (between which it is usual to place vulcanized fibre or wood washer); an insulating plate between one rail end and the bed, and extending a short distance under the other rail; a metal plate slightly thinner than the insulating plate, contiguous to the latter, so as to resist the concussion of car and locomotive wheels moving across the rail joint from the insulating to the metal plate, and, at the same time, preserve insulation of joint.

In addition to the above, there are wooden blocks and iron plates to splice or bind the abutting ends of the rails; these splice bars are secured to the iron plate or chair by four vertical bolts, and when these are screwed up, the splice bars are brought to bear hard upon the inclined surfaces or sides of chair, thus making it impossible for the spreading apart of the rails. The usual number of fish-plate bolts and nuts are also used in securing the wooden blocks to the rail. We would say that these joints are equipped with



IMPROVED RAIL JOINT.

Kleman patent nut locks and washers throughout, and in this way the loosening of nuts upon bolts is prevented.

When the joint is thus put together, it forms a perfectly insulated one, as well as giving additional strength and support to the ends of the rails.

Regarding the life of the joints, we would say that they have been in continuous use on several of our great railroad systems for upwards of two years, and reports show that they are still in first-class condition, and the cost of maintenance has been little or nothing.

The Allison Manufacturing Company, Philadelphia, have completed arrangements for the sole manufacture of this joint in the United States, and Mr. J. S. Brewer, 1030 Monadnock Block, Chicago, has been appointed representative for the State of Illinois and Milwaukee. The joints have been largely used on the Delaware, Lackawanna & Western Railroad and Pennsylvania Railroad for upwards of two years, with most satisfactory results, and are on trial on many of the other roads, such as the Lehigh Valley; Chicago, Burlington & Quincy; Chicago, Rock Island & Pacific; and Chicago & Northern Pacific.

Buyers' Finding List.

(*Continued on page 259.*)

WANTED—

By young man with years of experience repairing locomotives, position with prospects of foremanship. Address,
LOCOMOTIVE ENGINEERING.

THE

ALLISON MFG. CO.,

MANUFACTURERS OF

FREIGHT CARS AND LOCOMOTIVE BOILER TUBES.

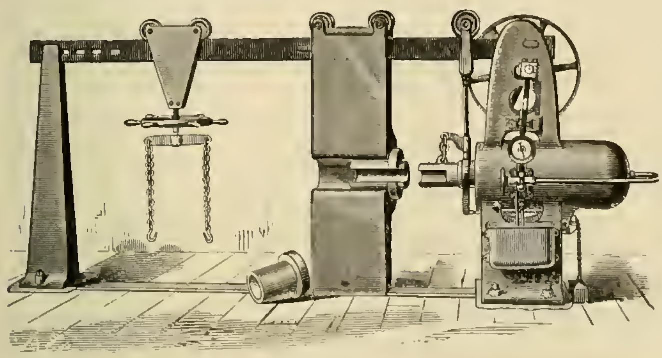
WROUGHT IRON PIPE OF SUPERIOR QUALITY.

PHILADELPHIA, PA.

William Sellers & Co. Incorp.

PHILADELPHIA, PA.

LABOR-SAVING TOOLS FOR LOCOMOTIVE SHOPS

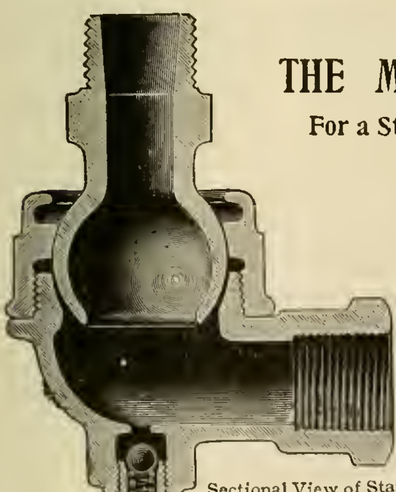


CRANES.

PLANERS,
TOOL GRINDERS,
BORING AND TURNING MILLS,
DRIVING WHEEL LATHES.
VERTICAL, HORIZONTAL DRILL PRESSES.
LOCOMOTIVE TURN-TABLES,
MILLING MACHINES,
STEAM HAMMERS,
AXLE LATHES.

CRANES.

Injectors for Locomotives.



Sectional View of Standard Railroad Joint, showing Automatic Relief Trap.

ADVANTAGES OF

THE MORAN FLEXIBLE JOINT

For a Steam Heating Connection Between Engine and Tender.

ALL METAL CONNECTION.
ABSOLUTELY FLEXIBLE.

Positively Steam Tight under ANY Pressure.

Indestructible Short of Wreck. No Delays. No Repairs. First Cost is the Only Cost.

STEAM, OIL, HOT ASHES, OR DIRT, does not affect its life.

MORAN FLEXIBLE STEAM JOINT CO., Inc'd.

HENRY U. FRANKEL, President.

149 THIRD ST., LOUISVILLE, KY.

The Pratt & Whitney Co., Hartford, Conn., U.S.A.

SINGLE AND DOUBLE HEAD MILLING MACHINES used as Substitutes for Planers for Heavy and Rapid Cutting in Cast and Wrought Iron and Steel.

TURRET-HEAD MACHINES AND TOOLS for Turning, Forming and Threading Irregular Pieces of Circular Cross-section in Brass, Iron and Steel.

METAL BAND SAWING MACHINES for Cutting Sprues from Brass Castings.

MILLING CUTTERS. HOLDERS, with Inserted Cutters for Turning, Shaping and Threading Metals. **SPIRAL SHEAR PUNCHES.**

CATALOGUE L SENT ON APPLICATION.

BUYERS' FINDING LIST—*Continued.*

CAR HEATING.
William C. Baker, New York.
Safety Car Heating & Lighting Co., New York.

CAR HEATING HOSE.
N. Y. Belting & Packing Co., New York

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.

CAR WHEELS.
Krupp (T. Prosser & Son, New York).
Ramapo Wheel & Foundry Co., Ramapo, N. Y.
Standard Steel Works, Philadelphia, Pa.

CAR WHEEL BORERS.
Manning, Maxwell & Moore, New York.

CAR WHEEL PRESSES.
Watson & Stillman Co., New York.

CASTINGS.
Lima Locomotive & Machine Co., Lima, O
McConway & Torley Co., Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

CASTINGS, STEEL.
Lima Locomotive & Machine Co., Lima, O
Sargeant Co., Chicago, Ill.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHANNELERS.
Ingersoll-Sergeant Drill Co., New York.

CHIME WHISTLES.
Crosby Steam Gage & Valve Co., Boston Mass.
Star Brass Mfg. Co., Boston, Mass.

COAL HANDLING MACHINERY.
Link Belt Engineering Co., Philadelphia, Pa.
The Pratt & Whitney Co., Hartford, Conn.

COAL CHUTES.
Williams, White & Co., Moline, Ill.

CONVEYORS.
Link Belt Engineering Co., Philadelphia, Pa.

CORRESPONDENCE SCHOOLS.
Internat'l Corres. Schools Scranton, Pa.

CUTTING-OFF MACHINES, COLD SAW.
Newton Mach. Tool Works, Philadelphia, Pa.

CRANES.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia, Pa.
Pedrick & Ayer Co., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANES, TRAVELING SWING.
Wm. Sellers & Co., Philadelphia, Pa.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

CYLINDER BORING AND FACING MACHINES.
Pedrick & Ayer Co., Philadelphia, Pa.

DRILLS.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O
Pedrick & Ayer Co., Philadelphia, Pa.
The Pratt & Whitney Co., Hartford, Conn.

DRILLING MACHINES.
Gould & Eberhardt, Newark, N. J.
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(*Continued on page 260.*)

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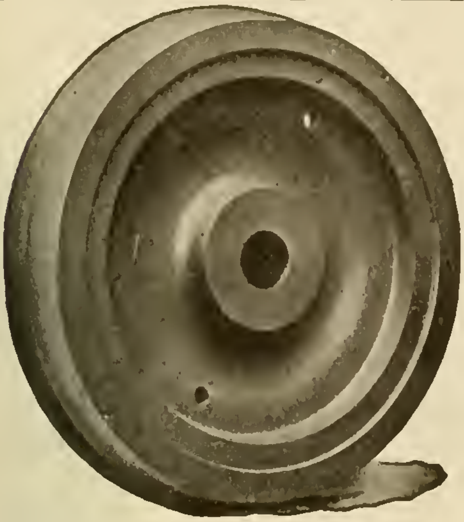

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(Continued on page 262.)

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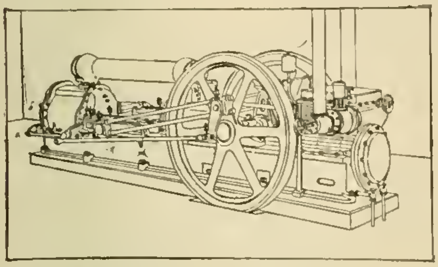

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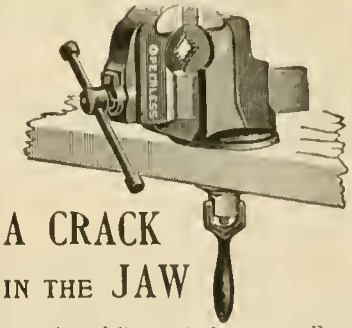

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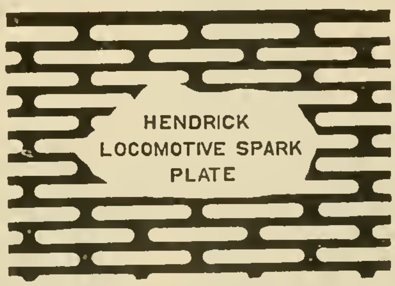

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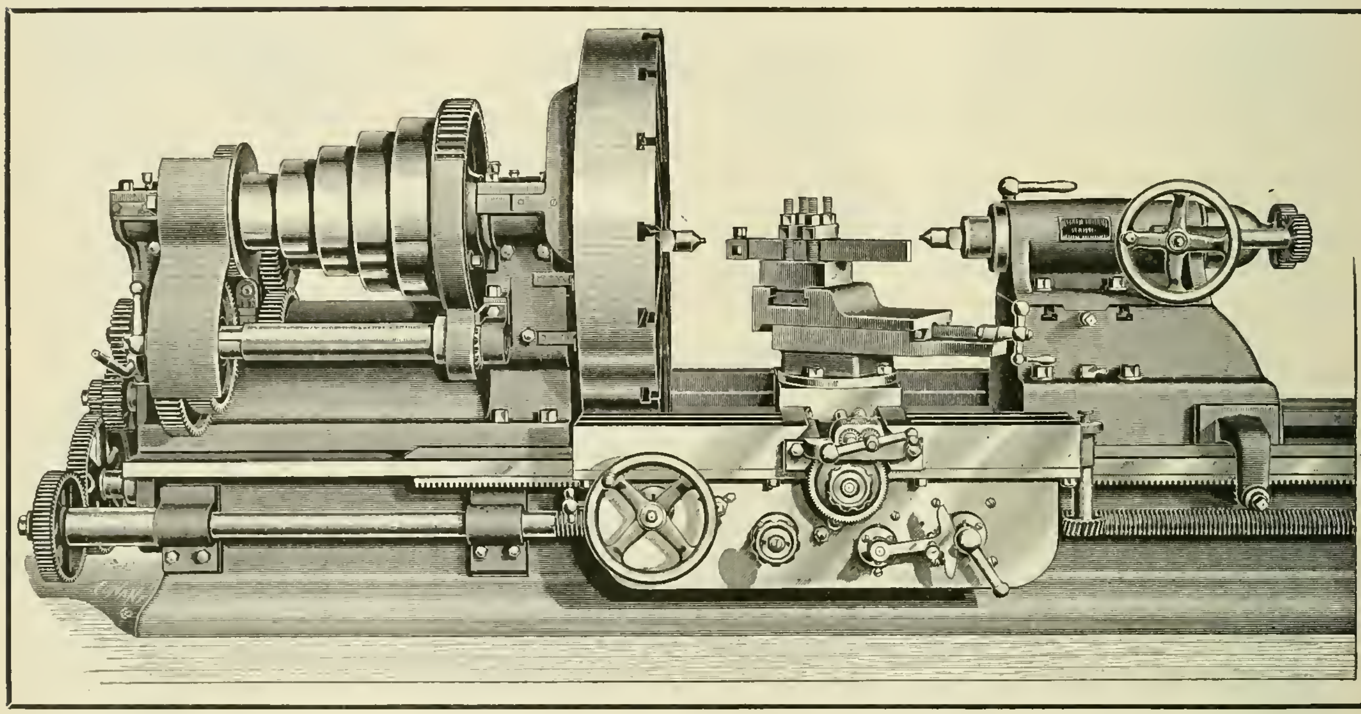

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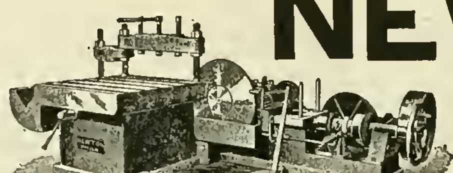

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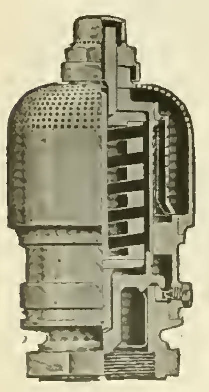

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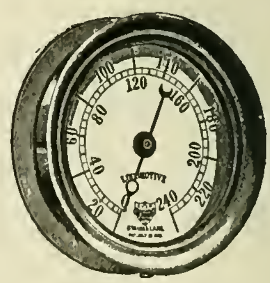

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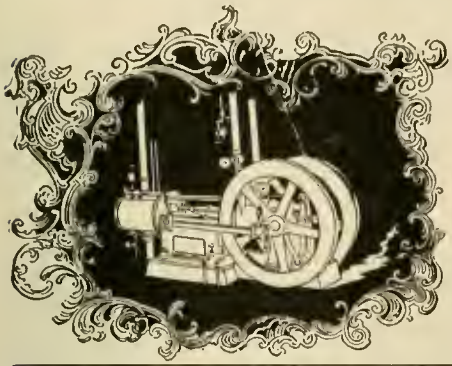

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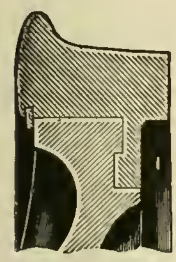

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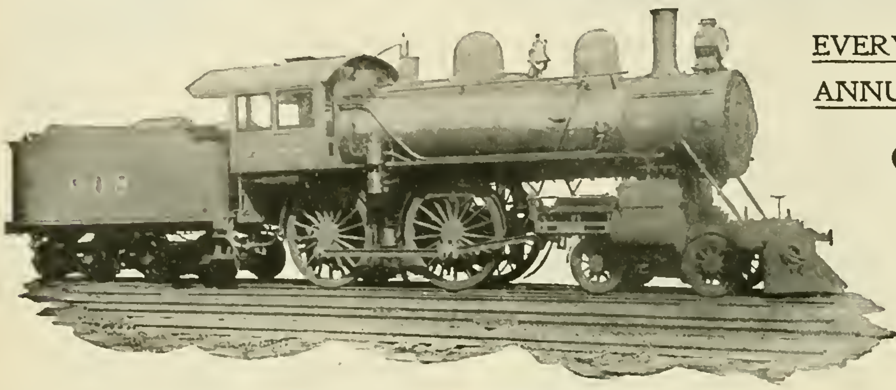

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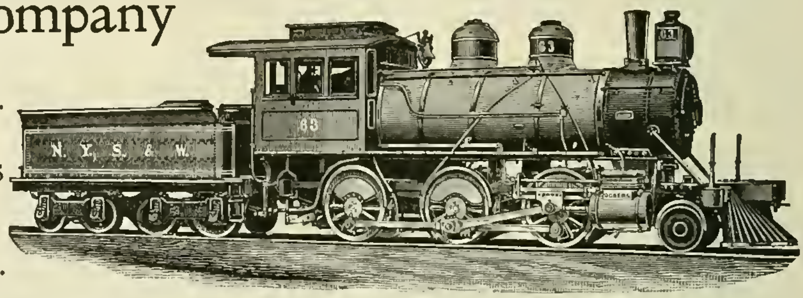

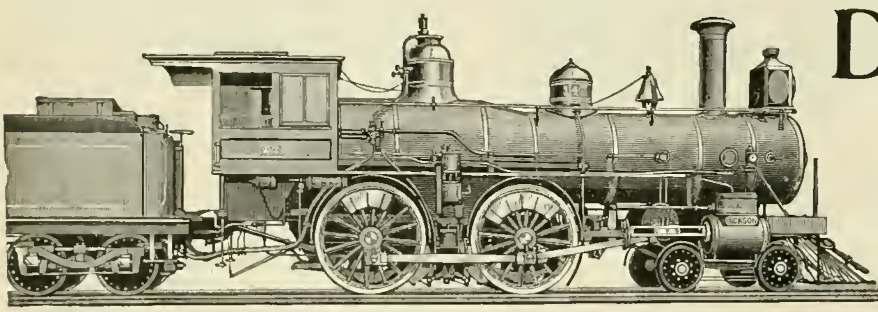

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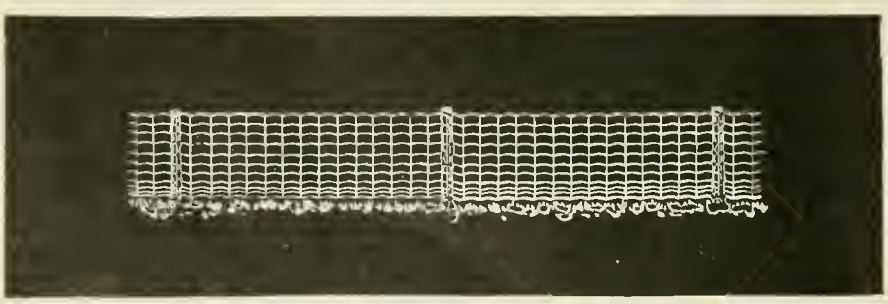

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Vol. X. NEW YORK, APRIL, 1897. No. 4.

Vice-President Hobart's Special Train.

The accompanying photograph shows the "Royal Blue Line Special Train," which conveyed Vice-President-elect Hobart and party from New York to Washington on March 2d, the photograph being taken before the train left the Jersey City station of the Central Railroad of New Jersey, by Mr. F. W. Blauvelt, many of whose photographs have been reproduced in these columns.

VICE-PRESIDENT HOBART'S TRAIN.

The train was composed of New Jersey Central engine No. 457, a Royal Blue Line baggage car and the following private cars: The "Baltimore," of the Baltimore & Ohio Railroad; the "Philadelphia," of the Philadelphia & Reading Railroad, and the "Atlas," of the Central Railroad of New Jersey. The train was made up in the order named, and the Vice-President and party rode in the Central's car "Atlas."

The train was in charge of Wesley Alpaugh, engineer; John Gesbocker, fireman; A. B. Prawl, conductor; Lee Fritz, baggage master, and C. Vanderbilt, brakeman. Mr. Henry Beck, travelling engineer, of the Central, was also on the engine.

The run to Twenty-fourth and Chestnut streets, Philadelphia (96 miles) was made in one hour and forty-one minutes, including a stop of six minutes at Trenton Junction to take on Governor Griggs and party, and a slow-down at Girard avenue.

A stop of nine minutes was made at Philadelphia to admit of some hand shaking, etc., during which time a change of engines was made. The train then proceeded to Washington.

The engine, as will be readily noted, is one of the Vauclain compounds, built by the Baldwin Locomotive Works for the Central Railroad of New Jersey.

The train was hauled from Philadelphia to Washington over the Baltimore & Ohio by engine No. 1313, one of the big ten-wheelers designed by Mr. Harvey Middleton, superintendent of motive power. The total distance from Jersey City to Washington is 228.5 miles, and the total time consumed was 248 minutes, with the actual running time of 233 minutes.

Standard Taper Gages for Bolts.

The uncertainty surrounding the question of standard tapers for reamers and bolts, and the crude devices for maintaining same as practiced in too many shops, has received the attention of General Foreman Elvin of the Huntington shops, who has adopted a system which he thinks covers the ground for all the needs of his particular case. The plan consists in making a series of holes, in cast iron blocks, the holes reamed to size and advancing by thirty-seconds from ½ inch to 1¾ inches. These blocks are then used to fit all tapered bolts to; the bolt never going to the job on which it is to be used until taken there for final assembling of the parts.

This system has stopped the running from lathe to the engine to make a fit, the latter always being done at the lathe, while the taper gage represents the job to be fitted. The idea has been further amplified so as to fit all tapped holes on the same principle, for either loose or steam-tight work. A saving has been seen from the start, which can be attributed to both the surety of fit by the gage process as well as to the total stoppage of trial trips to see how a bolt is going to fit, and incidentally talk over matters that have no immediate connection with the job in hand. All holes except those for through work like stay bolts are now tapped taper.

Machine Shops Sixty Years Ago.

In his opening address at the last meeting of the American Society of Mechanical Engineers, President Fritz said, in talking of his early experience:

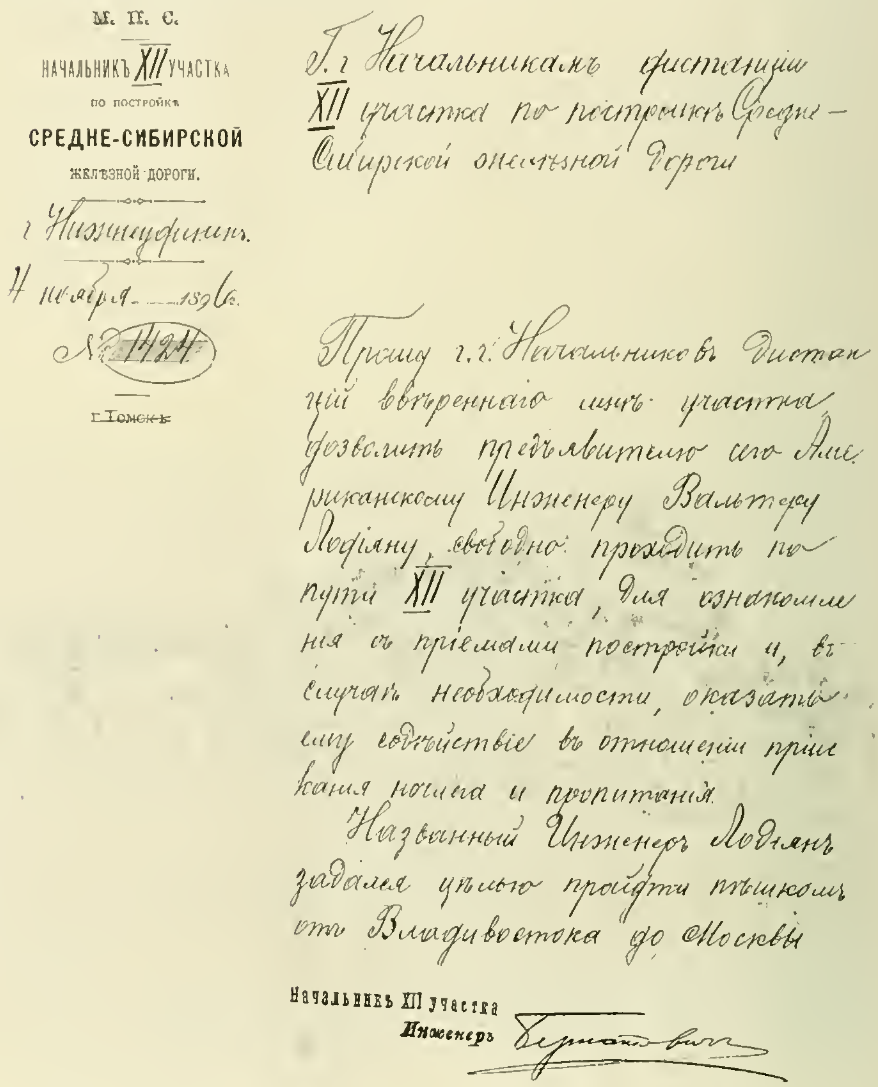
"My memory of machine shops dates back to 1832 and 1833. Within a short distance of my home there were three cotton mills (and large ones for those days), two woolen and two carding mills, and several grist mills, as they were called at that time. At one of the large cotton mills they had a machine shop, where the principal repairs for all the mills in the neighborhood were generally made. My father, being a millwright and machinist, as well as a small farmer, did all the important repairs for all the mills. The tools consisted of two small lathes for turning iron and one for turning wood; all of them had wooden 'shears' or beds. There was also a machine for cutting light gears, which to me was a great curiosity; there were several vises, and quite a number of small tools—one they called a 'doctor,' which was used to correct 'drunken threads,' as all screws of any importance were cut with the chaser.

"In 1838 I went to learn my trade. In the machine shop there were about the same number and character of lathes as in the shop mentioned, but they were larger, one of them being a double-ender, for the purpose of boring out wheels that were too large to swing over the shears. There was also a drill press made out of a lathe-head casting bolted against a 12 x 12-inch wooden post; it was not a very sightly machine, but it did good work for the time. We made small brass castings, built small boilers and small engines, and did all kinds of country machine and blacksmith work. We made our own patterns, without any drawings.

"In 1846 I became connected with a bar mill, and practically the only tool they had was a roll lathe with the old-fashioned fixed rest, and the tool was regulated by keys driven with a chipping hammer. After a time, with a good deal of persuasion and some strong talk, I succeeded in getting some small lathes, a planer and a press drill. About this time some of the larger ironworks put in some better tools, but they were all small. Indeed, up to this time about all the tools we had were a two-hand chisel, a sledge, a chipping hammer and chisel, a file and a ratchet drill. The mills all being geared, we had a set of drifts to suit the keyways in the various wheels and shafts.

"In 1854 I went to the Cambria Ironworks, at Johnstown, and well knowing the importance of having good tools for the completion and perfection of such a plant as that was intended to be, I earnestly urged the company to get some of the best tools that were built, which they consented to, and at the same time had some special lathes built, and made much heavier than any that had been previously designed. This was the commencement of a better class of tools about an ironworks, and greatly facilitated the great improvements which soon after took place. But this is over forty years ago, and what was a good tool at that time is a very different one to-day, as the machine-shop equipments have fully kept pace with the times. The builders have not only perfected the machines in general use, by making them heavier, more powerful and more convenient, but they are building special tools for almost all manner of purposes, which greatly facilitates, perfects and cheapens the work, and renders it possible to get parts of a machine made in different shops and have them all fit together as though they had all been made in one place.

"Sixty years since, the small shop tools for a lathe consisted of a hook tool with a sharp tit on the bottom to hold it on the rest (which was made of soft wrought iron); the tool was made out of a steel bar about ½ x ¾ inch, generally put in a wooden stock 2½ inches in diameter, with a handle on the lower side, as you see on the wall. In addition to the tool just described, there was a finishing tool made in the shape of a spike head, cutting edge on both sides, one to do the cutting or finishing and the other to keep it in position on the rest; it also had a wooden handle, but of different construction from the handle of the hook tool, as it was held against the shoulder instead of under the arm. Next was a chaser, and last, as usual, was the 'doctor,' to cure in a measure 'drunken threads,' which frequently occurred. The small tools consisted of a pair of outside and an inside pair of cali-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Railway Material Needed in Japan.

The National Association of Manufacturers of the United States sent Mr. Robert P. Porter to investigate the commerce and industries of Japan. In the course of the report made to the association, Mr. Porter says: "The projectors of a factory for the manufacture of rolling stock for Japanese roads, which it was proposed to established in Tokio, figuring on the experience of the English railroads that one locomotive per three miles, and one and one-half passenger coach per mile and ten freight cars per mile are required, estimated that a year or more ago there was a deficiency on the Japanese railroads of

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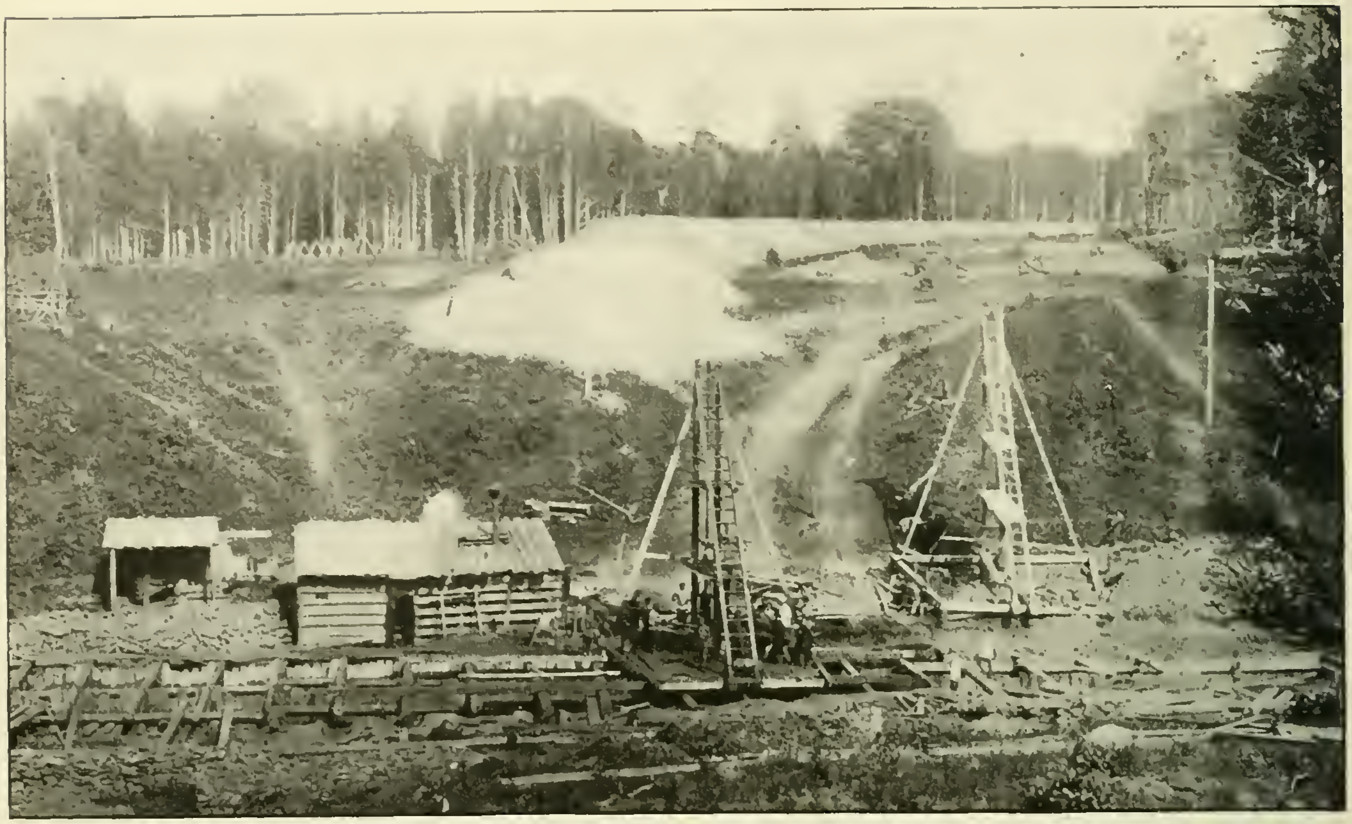
"If, within the next ten years, the mileage of railroads in operation should increase to only 20,000 miles, and making the liberal estimate that one locomotive be required per four miles and one passenger coach and five freight cars be necessary per mile, it can be readily seen that 5,000 locomotives, 20,000 passenger coaches and 100,000 freight cars must be provided. By a low estimate, the purchase of this equipment abroad would necessitate an expenditure of $15,000,000 (silver). In relation to this estimate of 20,000 miles, I asked Mr. Asano, president of one of the new steamship lines, who is in the United States at this writing, and he said it was a safe forecast."

The Florida East Coast Railroad has adopted the Harmon train order holder and will put one of the little mistake preventers on each of its engines. The adopted the Harman train order holder engineer can see it, night or day.



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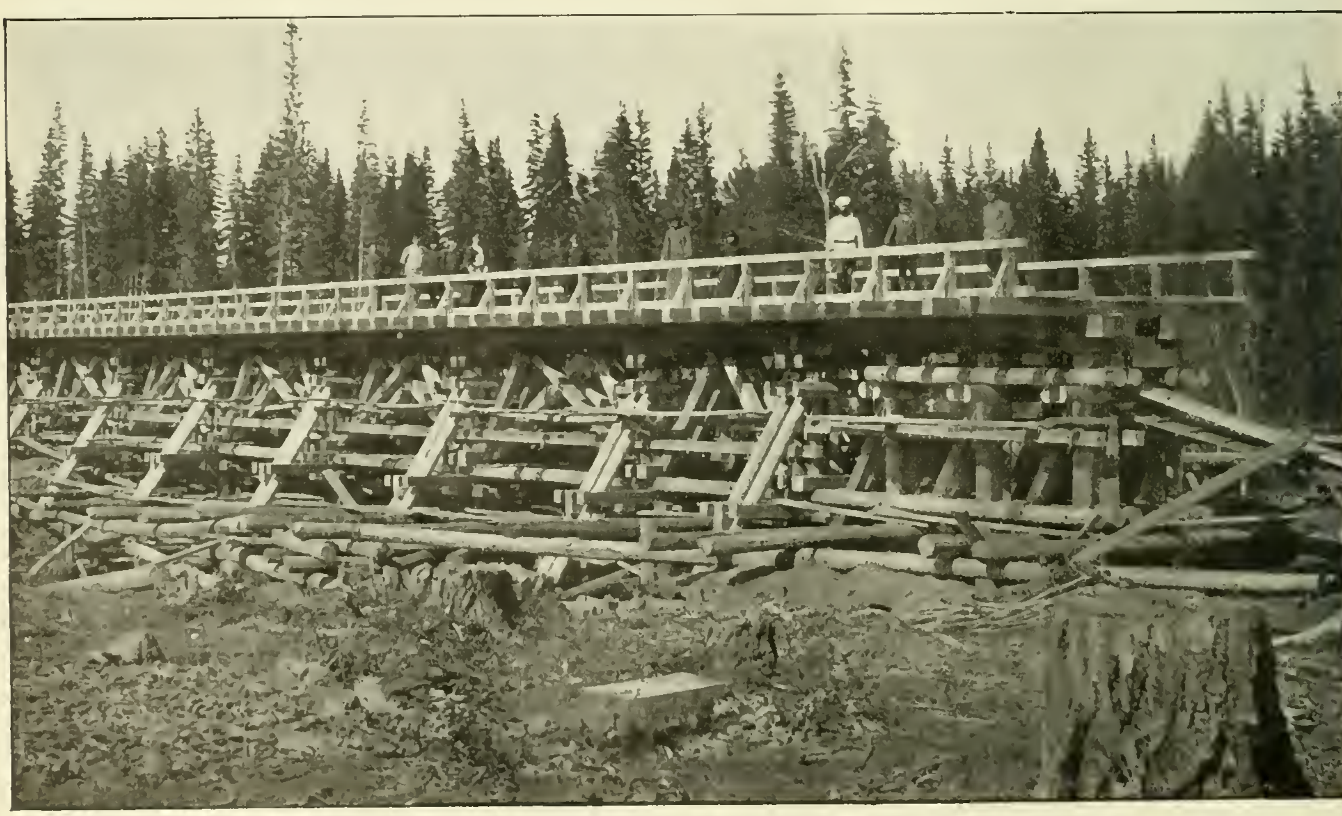


TINI BRIDGE NEAR KANSK, CENTRAL SIBERIA.

Locomotive with Corliss Valve.

Various attempts have been made in this country to apply Corliss valve gears to locomotives, but none of them approached making a success. Nearly all engineers are familiar with the humorous description given by the late Alexander L. Holley of the "Corliss Jigger," a locomotive with which he had too much personal connection. He said the trouble with the engine was, that in the course of a run she was sure to lose a barrowful of valve connections.

The problem of applying the Corliss valve gear to a locomotive appears to have been solved successfully in France. We produce from "Engineering" an illustration of a locomotive with Corliss valve gear, designed by M. Ernest Polonceau, of the Paris, Orleans Railway, and now running on that road. Indicator diagrams show that the engine, when running at 51 miles an hour, gives steam distribution that is not unlike the ordinary Corliss engine. In this locomotive, both the induction and exhaust valves have positive motion, and, as will be seen from the engraving, there is not much complication of parts. The engine seems to have the capacity of holding together, which is different from any Corliss locomotives ever built before, for she ran 40,000 miles without accident, and, on examination, the valve gears were all found to be in good condition and required no work to be done upon them. This seemed strange to the men in charge, for it appears that the slide valves on French locomotives have to be faced after running about 15,000 miles. The claim is made that the Corliss engine saves 6 per cent. of fuel over a slide valve engine of the same type doing similar work. We should imagine that the decreased clearance space, due to the valves being set at the ends of the cylinders, would alone account for this saving.

The advantages claimed for this form of valve gear are:

1. The steam, before entering the cylinder, is not so much cooled as in ordinary engines, because the steam chest and valves are not chilled by passage of the exhaust steam through them. The temperature of the latter is about 230 degrees, while that of the steam chest is 356 degrees Fahr. Thus, in ordinary engines with a single valve there is a certain amount of condensation, which does not occur in the engine with four Corliss valves.

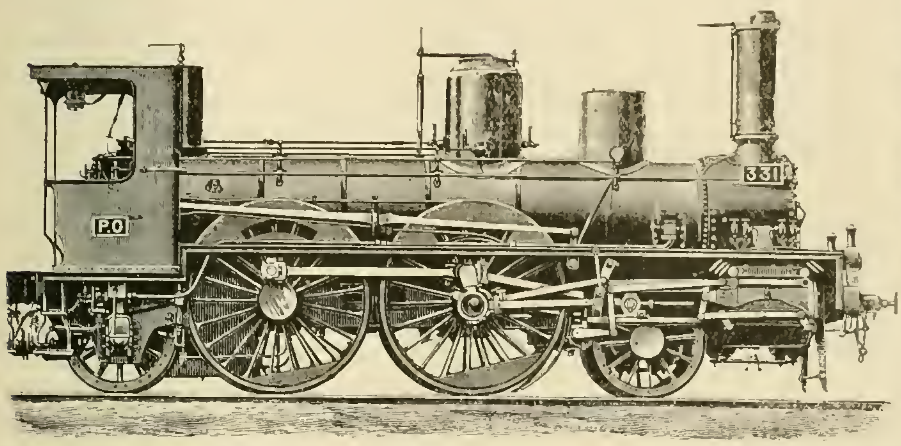
2. There is not the same loss in steam pressure during admission, because the steam enters through ports of about double the usual area.

3. The expansive force of the steam in the cylinder is better utilized, because the clearance space is smaller. The period of compression is shorter and of expansion longer—all conditions telling in favor of the new valve gear.

4. When reversing the valve, the power developed to stop the engine is greater, because the quantity of steam filling the clearance space is less and the exhaust valve has lead.

5. There is less valve friction, and the four valves being nearly balanced do not absorb as much power as one ordinary valve.

6. The two exhaust valves, being at the bottom of the cylinders, the water escapes through them by gravity, and the cylinder drain cocks are seldom required.



FRENCH LOCOMOTIVE WITH CORLISS VALVE GEAR.

Compressed Air Rather Than Electricity.

Mr. Fred. B. Griffith, master mechanic, Delaware, Lackawanna & Western Railroad, Buffalo, N. Y., is not so enthusiastic about the use of electricity for power purposes as many of our electrical friends are. In the course of a paper which he read at the Central Railroad Club lately, he said:

"We are tempted to say that if the power from Niagara Falls was transmitted by compressed air instead of electricity, it would be found to be cheaper in first cost, cheaper in transmission, and much more useful and economical in its application, inasmuch as it could be applied to existing steam engines with slight modifications, whereas, as now adopted, the manufacturers who own expensive engines will have so much capital lying idle on their hands and will have to expend large sums for electric motors. We believe that we should direct our efforts more to perfect our methods of compressed air transmission of power than electric transmission, and deem it far more economical and convenient for our machine shops, except in very rare instances, and these will be easily seen when circumstances point them out.

"Of course, we may expect to hear of further discoveries in electricity, such as its production directly from fuel, or, at least, a cheaper method of production, or a combination whereby we might help our steam locomotives over our mountains by the application of electric motors to the engine trucks, tender trucks, and even the car trucks. The current might be generated by our mountain torrents, to overhead wires, from which it might be collected by the usual trolley system. In the future perhaps some such system may be perfected for increasing the power and speed of our steam locomotives, but at present we look on such prophecies as visionary. But great progress has been made in this science, still greater ones may yet come; but railway master mechanics may well say, in relation to the transmission of power in their shops, 'Let us wait.'"

LODIAN ON HIS TRAVELS IN SIBERIA.

Work of the Flanging Press.

The extent to which pressed shapes are used in locomotive construction is not fully understood by every one interested in shop affairs, and we might say that the same lack of information can be traced still farther so as to embrace many that are in close touch with most things that go to make up what is known as modern practice.

This was forcefully brought home to us on a recent visit to the Schenectady Locomotive Works, after a brief examination of an immense collection of dies for use on the hydraulic flanging press; an exhibit that represented a cost which needs several figures to express it. Of course the flanging press would be a useless investment without the dies, and the latter therefore are not entitled to any particular credit for being in evidence, but the lesson they convey is the business proposition that the machine shall be made to give a return for the money locked up in the price of it. That it does this is best shown by the results obtained, as well as by the increasing number of dies.

Besides the flanging of boiler heads, throat sheets and flue sheets, which was supposed to, and does, embrace the principal output of most boiler-shop flanging devices, there are so many uses for the tool that the primary object of its installment is now practically overshadowed by its new duties. A summary of a few of these, comprises heads for main air reservoirs; front end rings and doors, and the latter by the way are made with a finish and lightness that eclipses anything thus far made of cast iron.

The new method of dome construction at these works does away with the cast iron ring, and in its stead a piece of one-inch steel plate is flanged into the shape of the old casting, to which the dome-body is riveted. The base of the dome is also made of one-inch steel and flanged to the curvature of the boiler, thus making a dome of steel in three parts, with a base that has an unbroken flange at its junction with the boiler. Dome casings and sand boxes are made by the 3-piece process substantially the same as in the foregoing case, by flanging the base and top separately and riveting both to a central ring.

Cylinder-head casings, steam-chest casings, and smoke-stack bases are flanged and made lighter than ever has been done by any process prior to the advent of the press, which is now recognized as one of the most important factors in cheapening the cost of production in large manufacturing plants where the forming of metals is involved, simply because but one movement of the rams comprises all the manipulation necessary, and all parts formed in the same dies are absolutely alike. It is an interesting sight to see a steel plate more than one inch thick forced into intricate shapes with no greater apparent expenditure of energy than would be required with a thin sheet of material.

An Air Engine at Clifton Forge Shops.

What is perhaps one of the most unique designs of a small engine for actual service in the shop, is that built at the Chesapeake & Ohio shops at Clifton Forge, and used for boring cylinders, facing valve seats, and at points about the shop to drive tools where light power is required.

It was designed and built by General Foreman A. G. Elvin, now of the Huntington shops, prior to his connection with the latter place. Fig. 1 shows a little 3½ x 6-inch engine with a valve motion of the Corliss type, mounted on wheels so as to be handed easily about the shops. Fig. 2 shows the engine coupled up to a boring bar. To the inquiring mind it may not be plain why the refinements of a wrist plate and rocking valves should be used on an engine with a constant cut-off of 75 per cent. of the stroke, when a plain slide valve would answer all purposes, and we will explain that a governor was considered, but omitted on account of the expense involved. The engine is built up from picked-up parts; the cylinder being made of a rod bushing, and the valve seats out of oil-cup bodies; the only really new part being the bed. It is a good example of small engine design for home use, but would hardly hold its own as a commercial product, against hot competition; and this holds good with a great many valuable shop schemes.

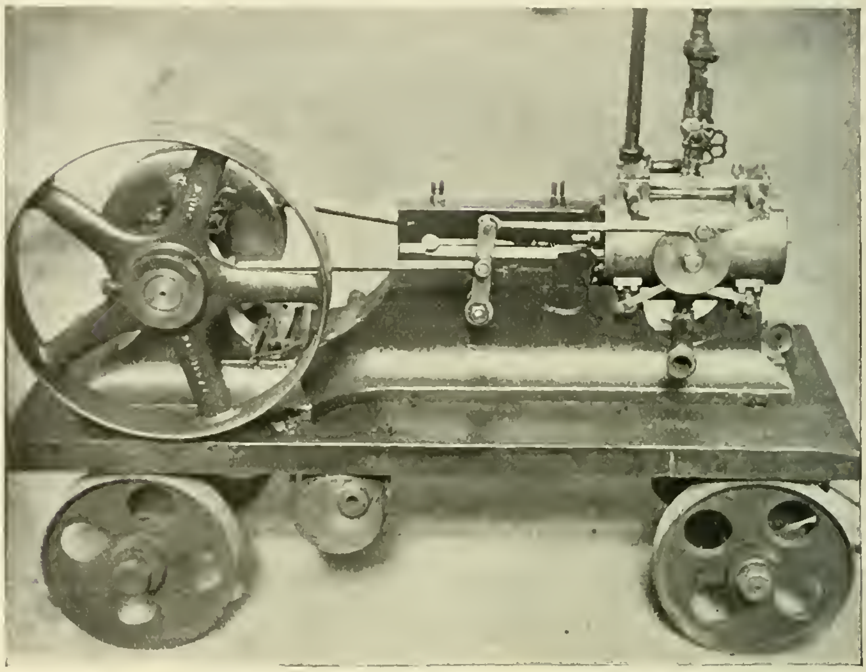


Fig. 1. AIR ENGINE.

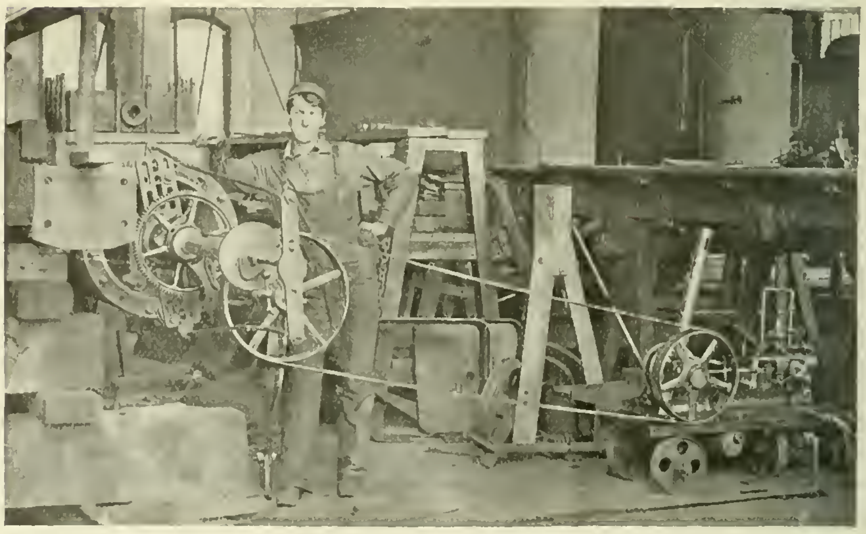
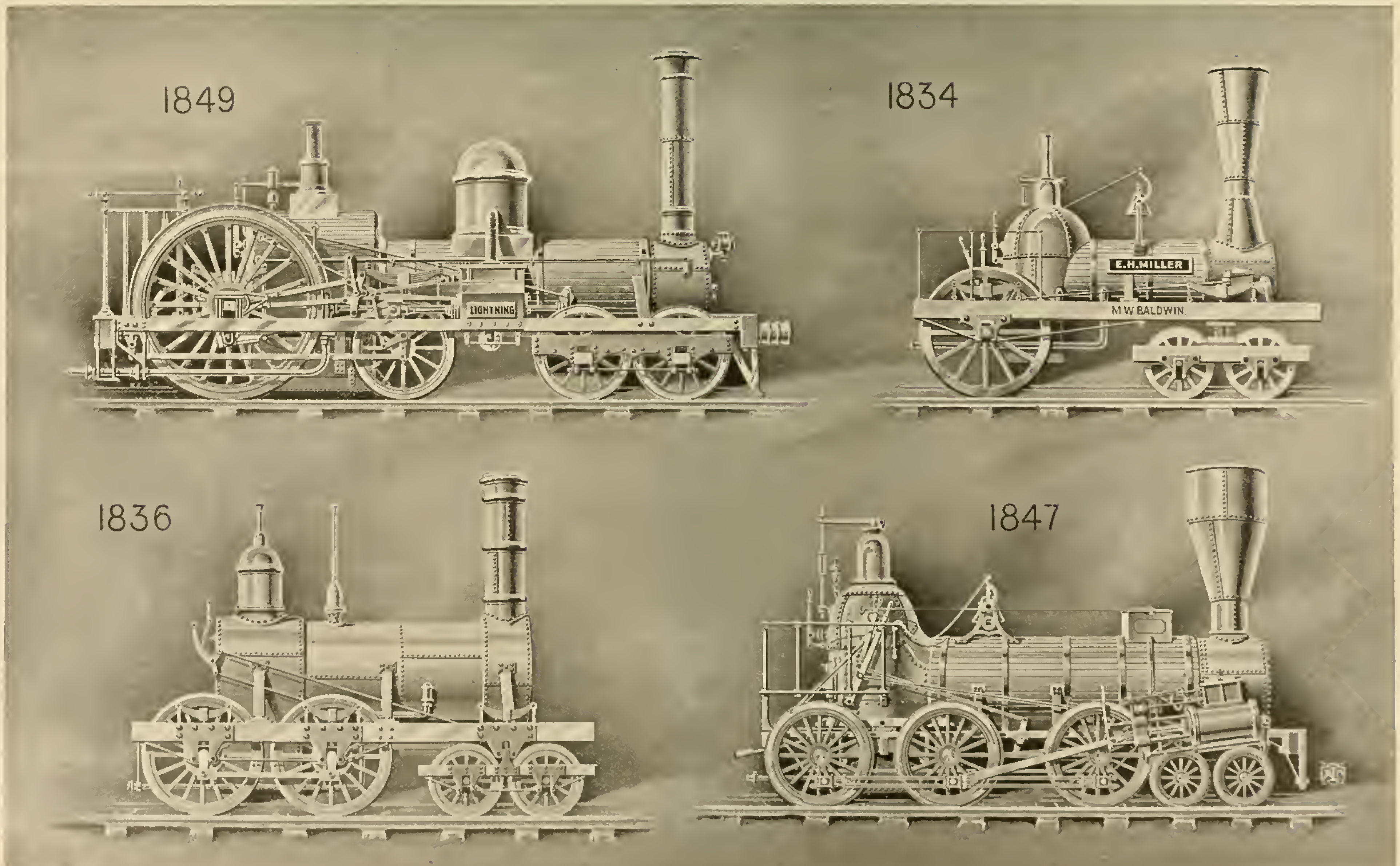


Fig. 2. AIR ENGINE.



1849. First "Crampton" built in America.

1836. First eight-wheeler. H. R. Campbell, designer.

GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 4.

1834. Baldwin's first design and second engine. First of a class.

1847. First ten-wheeler. Septimus Norris, designer.

Locomotive for Japan Railway Company.

Our half-tone illustration of an engine of the Columbia type shows a 16 x 22 narrow-gage machine built at the Baldwin Locomotive Works for Japan, which has decidedly prominent American characteristics exteriorly, after the buffers and the bicycle headlights are excepted. It is only when we examine the details entering into the make-up of the firebox, that we see the working of an influence not home-bred, for it is of copper with copper staybolts, and the flues are of brass.

The heating surface of 1,559 square feet is a very liberal one for an engine with cylinders of the size noted, being equal to that on many of our 20 x 24 engines, and

Valves—Balanced.

Diameter of driving wheels over tires—56 inches.

Diameter of driving wheel centers—50 inches.

Driving wheel base—6 feet.

Rigid wheel base—12 feet.

Total wheel base—22 feet 6 inches.

Engine truck wheels, diameter—28 inches.

Engine truck wheels, kind—Vauclain steel-tired.

Trailing truck wheels, diameter—33 inches.

Trailing truck wheels, kind—Vauclain steel-tired.

Driving-box material—Cast iron with phosphor bronze bearings.

Firebox, width inside—60 inches.

Firebox, material—Copper.

Firebox plates, thickness of side and back sheets—½ inch.

Crown sheet, thickness—⅝ inch.

Tube sheets, thickness—½ and ⅞ inch.

Firebox staybolts, kind—Copper.

Tubes, material—Brass.

Tubes, number—189.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—14 feet 11 inches.

Heating surface, tubes—1,461 square feet.

Heating surface, firebox—98 square feet.

Heating surface, total—1,559 square feet.

BALDWIN LOCOMOTIVE FOR JAPAN.

so with the grate area of 30 square feet, which is greater than the average of our four-wheel connected engines, and also of many 10-wheelers. This would lead to the inference that the fuel to be used—soft coal—was not extremely high in calorific value. In any event the engine should be a good steamer with even ordinary fuel, and we believe our friends on the other side will be able to utilize all this heating surface to advantage.

With a boiler pressure of 180 pounds, the drawbar pull, after making deductions for internal resistance, will be 14,600 pounds, making the ratio of adhesive weight to tractive power equal to 3.55, which shows the cylinders, small as they are, to be plenty large enough to slip the wheels under anything but the most favorable conditions. A general description of the engine will be found below:

Type—Four wheels connected, with trailing wheels under firebox.

Simple or compound—Simple.

Gage—3 feet 6 inches.

Fuel—Soft coal.

Steam pressure—180 pounds.

Diameter of cylinders—16 inches.

Stroke—22 inches.

Pistons—Cast iron with steam packing.

Piston rods—Steel.

Diameter and length of driving axle journals—7⅛ x 8 inches.

Diameter and length of engine truck axle journals—5½ x 8 inches.

Diameter and length of trailing axle journals—6½ x 9 inches.

Brakes—American non-automatic vacuum brake on drivers and tender.

Safety valves—Two Coale encased valves.

Insulation—Magnesia sectional covering.

Lubricators—Nathan's.

Packing—U. S. Metallic.

Weight on forward truck—25,400 pounds.

Adhesive weight—52,000 pounds.

Weight on trailing truck—22,600 pounds.

Total weight in working order—100,000 pounds.

BOILER.

Type—Straight, separate dome for whistles and safety valve.

Material—Homogeneous cast steel.

Outside diameter at small ring—58 inches.

Thickness of plates—$\frac{9}{16}$ inch.

Horizontal seams—Double riveted.

Firebox, length inside—72 inches.

Grate area—30 square feet.

Boiler supplied by two No. 8½ Sellers 1887 injectors.

TENDER.

Frame, kind—Channel iron.

Trucks — Four-wheeled, with square wrought iron frame.

Wheels, kind—Vauclain steel-tired.

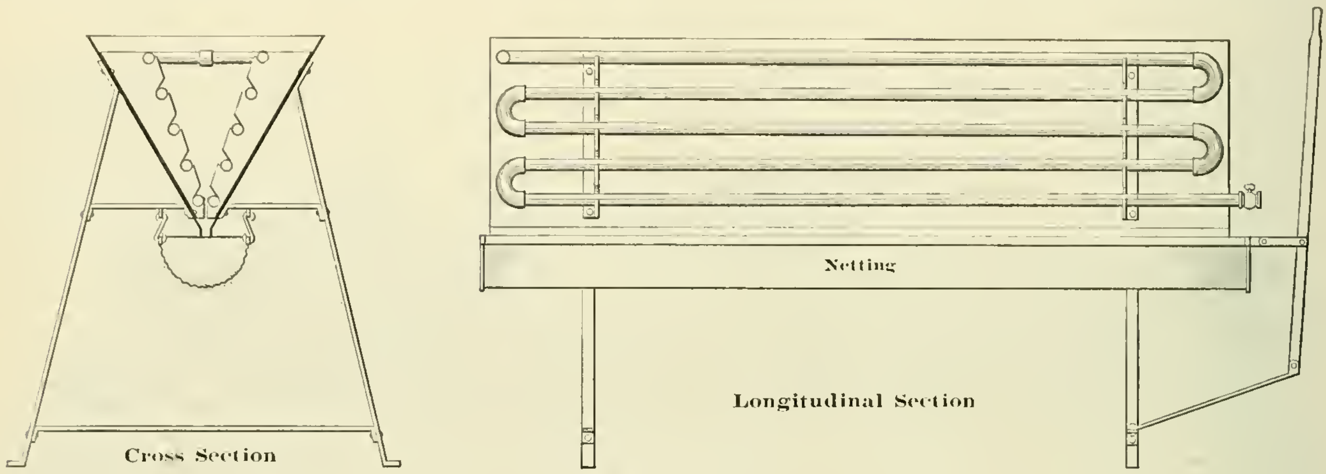
Wheels, diameter—33 inches.

Truck axle journals, diameter and length—4¼ x 8 inches.

A correspondent in Pennsylvania sends us some newspaper clippings respecting immense speed made by the Holman locomotive—the three-story affair turned out of Baldwin's some months ago. Our correspondent says that great claims are made for the engine, and that many enginemen of his acquaintance want to know from "Locomotive Engineering" what we think of the machine. We can give our opinion in very few words, and that is—It is a humbug. It is sound engineering to hold that every piece added to a machine after it has reached the practical stage, is a source of weakness. A treble set of wheels under a locomotive would be proposed only by one who knows nothing about mechanics.

Steam Sand Dryer.

The sand dryer here illustrated, is one patented by Mr. Jos. H. Green, and has been in use for some time at the Southern Railway shops at Columbia, S. C. Moisture is expelled from the sand by means of two coils of 1¼-inch steam pipe, which are encased by sloping sides closed at the ends, but open at top and bottom; the box thus formed is made of ¼-inch iron, and is 8 feet long by 30 inches deep at the sides, giving a liberal capacity for sand. At the bottom the opening is 1½ inches wide, full length of the box, for the escape of the dried sand, which is received in the netting shown loosely suspended under the slot. The lever at the end is used to agitate the netting and sift the sand. The arrangement has done all that has been required of it so far, in a highly satisfactory way.



STEAM SAND DRYER.

More About Tired Locomotives.

Every now and again some paper publishes a lot of idiotic rot about locomotives that get tired and have peculiarities which no sane person ever witnessed. There is exactly the same sense in writing about a locomotive getting tired or spunky as there is to say that wheelbarrows and sewing machines become animate at times and display temper. The latest paper to distinguish itself in this way is the "San Francisco Examiner."

We think that some of the statements made by the "San Francisco Examiner" are a little more idiotic than anything we have seen previously printed in this line. After telling a romance about a locomotive which persistently lost time in the beginning of a trip through bad steaming until it prevented a collision by failing to reach the place where a lap order had been given, and then steamed all right after the other train had been met at a station, it goes on to say:

"Half the Western locomotive engineers have had a heap of experiences with tired and spunky engines. Now, you may laugh at that, but it's a fact. I have never had an engine yet that did not get tired and have to go and rest in the roundhouse for a day or two, when it would start off just like a rested coyote. I used to have an engine on the Iron Mountain Railroad that would get tired just like a child once in a few months, and do what we might, coax and tease it as best we could, it would not make time. Give it a lay-off in the roundhouse for two or three days, and, gosh! how it would take the bit in its teeth and just go! Once when my engine was getting a tired spell and I had been losing time for a week, I was called up to the superintendent's office in Little Rock, Ark.

"'How does it come that you are doing so poorly with that locomotive?' said he. 'It's the best we have down this way and a fine one, too.'

"'It's tired,' said I, 'and needs a rest.'

"Well, you ought to have seen how that man haw-hawed at me. He thought it one of my jokes. I offered to bet a suit of clothes that no one could get better time out of her than I, and he took the bet. He put old Roger Adams—a great engineer, by the way—on in my place one day, and the engine came in half an hour late with the express train that night. Then I begged him to give the machine a simple rest for three days. The Superintendent rode in the cab out of Little Rock with me after the rest, and I shall never forget how surprised he looked when he saw how the engine slid over the rails that morning.

"'I never would have believed it,' said he.

"I noticed that he gave lots of other engines rests after that. Barbers tell me that their razors get tired the same way sometimes, and that a rest of a few weeks makes them as good as new.

"As a rule, the locomotive engineers out here in the Far Western States and Territories think a good sight more of their engines than the Eastern engineers do of theirs. I have known some engineers out here who have as much affection for their engines as a man has for his dog, and will coddle and work over the machinery as much as with a living being. Many a Western engineer will stick to an old, rickety locomotive after it has become so worn and old as to be dangerous, because he can't bear to give up his old machine. I suppose the monotony of the dead level, brown and barren plains and the hundreds of miles the Western railroad men travel without seeing a village or even a huddle of houses makes them more attached to their engines.

"Old Hank Turley, who ran on the Central Pacific from Ogden to Reno for twenty-five years, would never sleep anywhere else except in his engine cab when he was out on the road, because he said he knew from hundreds of experiments that his own engine wanted constant company day or night in order to get the best speed out of her. He told me that he had left his engine alone several times in the roundhouse at night just to prove to himself that he was not mistaken in his belief, and that he invariably made poor time and had much trouble about the machinery for several days thereafter."

A large passenger engine of the Columbia type, which the Baldwin people built for the Chicago, Burlington & Quincy about eighteen months ago, has been taken back and changed. The engine was notable for having a particularly large firebox and combustion chamber, 34 inches long. The grate area was 44.47 square feet. In service, it developed that there was deficient boiler circulation, caused by the long combustion chamber. Otherwise the engine gave excellent service, and was a particularly good steamer. A much smaller firebox has been applied to the engine and the combustion chamber left off. In connection with this, it is interesting to note that the Delaware, Lackawanna & Western have taken the combustion chamber out of several Wootten firebox locomotives, and they find the circulation is improved.

Northern Pacific Ten-Wheel Compound Engine.

The Schenectady Locomotive Works have just completed two ten-wheel compound freight locomotives for the Northern Pacific Railway, from designs worked out by Superintendent of Motive Power E. M. Herr, in consultation with the Schenectady Locomotive Works.

Our half-tone is a picture of the largest engines of this type thus far built. They are two-cylinder compounds with the intercepting valve of the builders, which allows the engine to be operated as a simple or compound engine at pleasure. A distinctive feature of these engines, lies in the mammoth boilers which furnish a heating surface of nearly 2,900 square feet, and the large use of steel, cast, forged and pressed, in order to keep the weight of details within the minimum, and thus obtain the liberal heating surface with a stated weight.

In a test on the hill at Schenectady—an ideal place for trying the power of an engine—one of these ten-wheelers developed 1,200 horse-power while operating as a compound, and gave equally satisfactory evidence of good work as a simple engine. Some interesting particulars of dimensions and fittings are given herewith:

Type—Ten-wheeler.

Simple or compound—Compound.

Gage—4 feet 8½ inches.

Fuel—Bituminous coal.

Diameter of cylinders—H. P., 22 inches; L. P., 34 inches.

Stroke—26 inches.

Horizontal thickness of pistons—4¾ and 5¾ inches.

Diameter of piston rods—3¾ inches.

Size of steam ports—H. P., 20 x 2⅛ inches; L. P., 23 x 2⅛ inches.

Size of exhaust ports—H. P., 20 x 3 inches; L. P., 23 x 3 inches.

Size of bridges—1⅜ inches.

Kind of valves—Allen-American.

Greatest travel of valves—6½ inches.

Outside lap of valves—H. P., 1¼ inches; L. P., 1⅛ inches.

Inside clearance of valves—H. P., ¼ inch; L. P., ¼ inch.

Lead of valves in full gear—0.

Kind of piston rod and valve stem packing—Jerome metallic.

Diameter of driving wheels over tires—63 inches.

Material of wheel centers—Cast steel.

Driving-wheel base—14 feet 10 inches.

Rigid wheel base—14 feet 10 inches.

Total wheel base—25 feet 11 inches.

Total wheel base of engine and tender—52 feet 0¼ inches.

Total length over all—61 feet 4½ inches.

Engine-truck wheels, diameter—30 inches.

Engine-truck wheels, kind—Standard steel tire, spoke center.

Adhesive weight—126,000 pounds.

Weight in working order—172,500 pounds.

Total weight of engine and tender—264,550 pounds.

Driving-box material—Cast steel.

Diameter of driving-axle journals—9 inches main; F. and B., 8½ inches.

Length of driving-axle journals—11 inches.

Diameter and length of main crank-pin journals—6½ x 6 inches.

Diameter and length of side-rod journals—Main pin, 7 x 5¼ inches; F. and B., 5½ x 4½ inches.

Brakes, driver—American, air, on all wheels.

Brakes, water—Le Chatelier.

Brakes, tender and train—Westinghouse automatic, 9½-inch air pump.

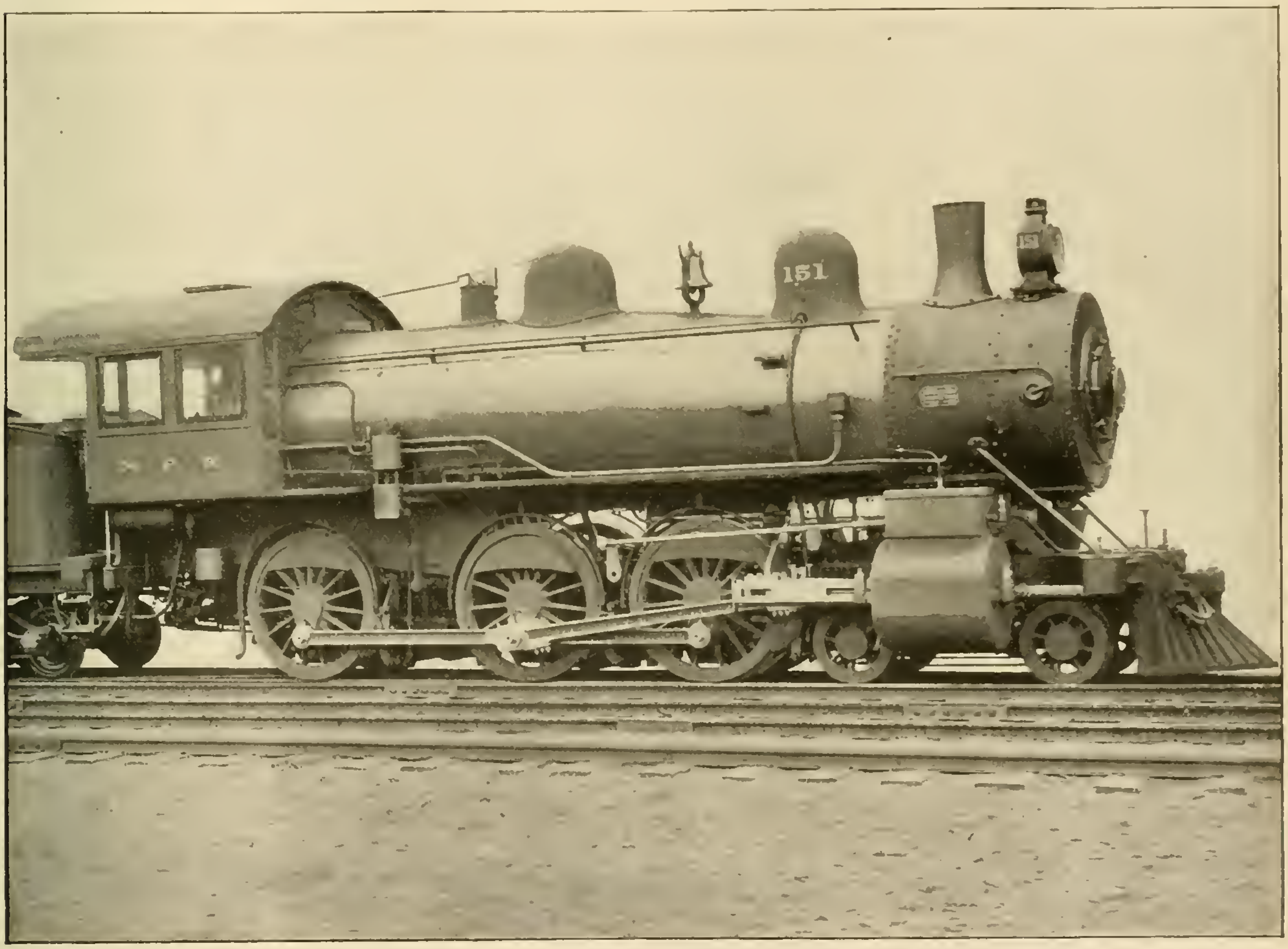
Air signal—Westinghouse.

Safety valves—Three 3-inch Ashton pops, two open, one cam lever.

Insulation—Sall Mountain asbestos.

Sanding device—Dean's.

Blow-off cock—McIntosh.



HEAVY NORTHERN PACIFIC TEN-WHEELER.

Brake beams—Kewanee reversible.

Headlight—Star, 16-inch round case.

BOILER.

Type—Extended wagon top.

Material—Carbon steel.

Outside diameter at small ring—70 inches.

Thickness of plates—11-16, ¾, ⅝, 9-16 and ½ inch.

Horizontal seams—Butt joint, sextuple riveted, with welt strips inside and outside.

Circumferential seams—Double riveted.

Firebox, length—Inside, 120 3-16 inches.

Firebox, width—Inside, 41 inches.

Firebox, depth—Front, 84 inches; back, 71 inches.

Firebox material—Carbon steel.

Firebox plates, thickness—Sides, 5-16 inch; back, 5-16 inch; crown, ⅜ inch; tube sheets, ½ inch.

Water space—Front, 4½ inches; sides, 3½ to 4 inches above grate; back, 3½ to 4½ inches at crown.

Firebox crown staying—Radial stays, 1⅛ inches diameter.

Firebox staybolts—Ulster special iron, 1 inch diameter.

Tubes, material—Charcoal iron, No. 12 W. G.

Tubes, number—378.

Tubes, diameter—2 inches.

Tubes, length over tube sheets—13 feet 6 inches.

Fire brick, supported on four water tubes.

Heating surface, tubes—2,655.4 square feet.

Heating surface, water tubes—32.1 square feet.

Heating surface, firebox—208 square feet.

Heating surface, total—2,895.5 square feet.

Water area—34.22 square feet.

Grate, style—Rocking.

Ash pan—Sectional.

Exhaust pipe—Single, high.

Exhaust nozzles—5¼, 5½ and 5¾ inches diameter.

Smoke stack, inside diameter—18 inches at top, 16 inches near bottom.

Smoke stack, from rail to top—14 feet 10½ inches.

Boiler supplied by two Sellers Improved Class M, No. 10½ Injectors.

TENDER.

Frame, kind—10-inch steel channels.

Truck—4-wheeled, channel iron, center bearing; side bearings on back truck.

Wheels, kind—Plate, cast iron.

Wheels, diameter—33 inches.

Journals, diameter and length—4½ x 8 inches.

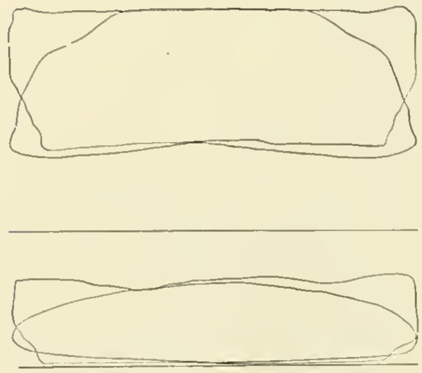
Wheel base—15 feet 3 inches.

Water capacity—4,350 United States gallons.

Coal capacity—9 (2,000-pound) tons.

Weight of tender, empty—37,800 pounds.

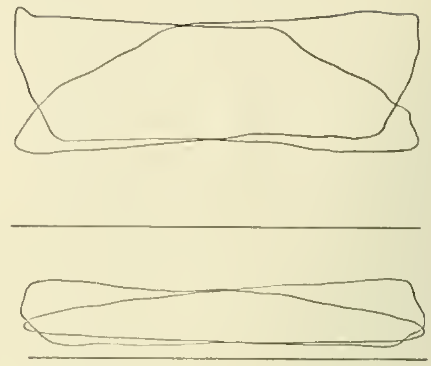
Indicator Diagrams from Northern Pacific Twelve-Wheeler.



Rev. per Minute.	56
Miles per Hour.	9.1
Piston Speed in Ft. per Min.	280
Steam Pressure.	200
Horse Power.	818
Work done by L. P. Cyl.	55.1%
Throttle.	Full.

Locomotive Engineering

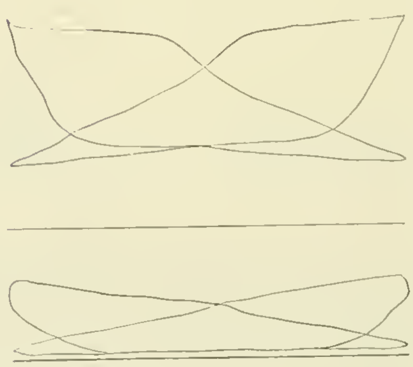
No. 32



Rev. per Minute.	112
Miles per Hour.	18.3
Piston Speed in Ft. per Min.	560
Steam Pressure.	195
Horse Power.	1230
Work done by L. P. Cyl.	52%
Throttle.	Full.

Locomotive Engineering

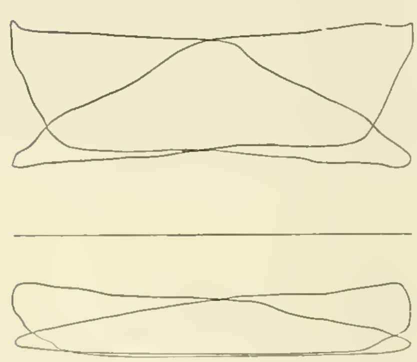
No. 135



Rev. per Minute.	114
Miles per Hour.	18.6
Piston Speed in Ft. per Min.	570
Steam Pressure.	195
Horse Power.	904
Work done by L. P. Cyl.	56.7%
Throttle.	Full.

Locomotive Engineering

No. 101



Rev. per Minute.	102
Miles per Hour.	16.7
Piston Speed in Ft. per Min.	510
Steam Pressure.	200
Horse Power.	1015
Work done by L. P. Cyl.	54%
Throttle.	Full.

Locomotive Engineering

No. 98

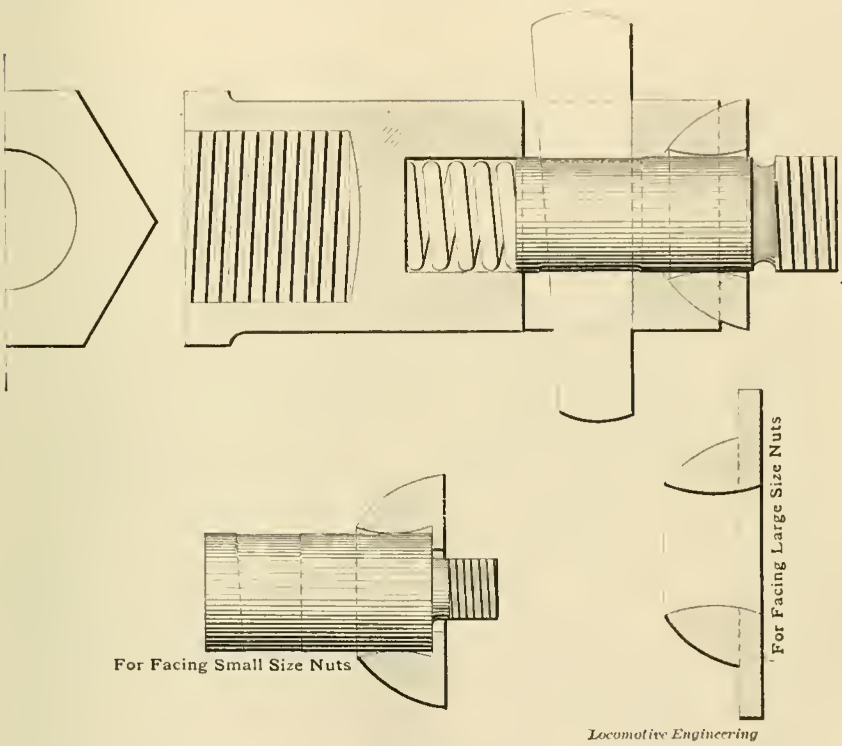
In connection with the indicator diagrams hereby shown, it will be noticed that the engines develop the highest horse power ever shown from locomotives running under 60 miles per hour. Writing about the diagrams, Mr. A. J. Pitkin, general manager of the Schenectady Locomotive Works, says: Agreeable to yours of the 15th, we are pleased to inclose blueprints of indicator diagrams taken from the Northern Pacific twelve-wheel compound locomotives, while operating on the grade of the New York Central out of Schenectady pushing freight trains. All of the cards shown, excepting 29 and 48, were taken while the locomotive was working compound; cards 29 and 48 were taken while the engine was working as a simple engine, each cylinder exhausting into the atmosphere.

We have been looking up particulars of the most famous run made with railway trains, and we are convinced that the run made over the Chicago, Burlington & Quincy from Chicago to Denver deserves to be considered the most extraordinary run ever made. The distance from Chicago to Denver, 1,025 miles, was covered in exactly 1,069 minutes actual running time. This was only a small fraction less than one mile a minute for the longest continuous run ever made by any railroad company. A notable thing about the run was that no special preparation whatever was made for the trip. The various engines that pulled the train were selected as those most convenient, and the crews were those that were accustomed to the engines. There were no delays from hot boxes or any other cause, and it looks as if trains could be run daily over that long distance and make the time of that special train.

Chuck for Facing Nuts.

A nut-facing chuck possessing more good points than one, to excite the interest and take the fancy of the mechanic, is shown herewith, engraved from a print furnished by Mr. H. A. Fergusson, assistant master mechanic of the Meadows shops of the Pennsylvania R. R. This chuck is so original in its make-up that it has but few things in common with the old friend of our youth on which we were wont to maul the nuts into position, and off again by means of the handle of the tool post wrench.

This chuck embraces five separate parts, namely: the body bored and threaded to fit the lathe spindle, the mandrel which carries the nut, the plano-convex washer against which the nut is held when being faced, the key and the helical spring. All these parts are used for all sizes of nuts, except the mandrel and washer, as shown in detail, which are made for the various nuts and used in one chuck. The mandrels are made a loose fit in the nut, which is run on easily, and brought up tight on the thread and washer by a tap on the key, and as easily removed after facing; the function of the spring being to force the mandrel out and free the nut, when the key is backed out, and since the fit between the nut and mandrel is on only one inclined face of all the threads the nut is loosened at the same instant that the stress is taken off the key. This chuck which brings the faces of a nut parallel with each other, and also square with the thread, was designed by Mr. A. J. Kline, foreman at the Meadows shops.



NUT-FACING CHUCK.

The word "bully," which is now so much used, and has so many subjects which no other word properly fits, is of semi-railroad origin, and has been very much distorted from its original meaning. On the river Tyne, in the north of England, there were, in early days, a peculiar class of lighters used for conveying coal from the colliery tramways to the shipping stations. The men who manned these barges were called "boolies," which was the north-country corruption of the word beloved. The "boolies" were probably at first the beloved of the coal shippers, but by degrees sentiments changed, and the modern word "bully" became truly applicable to the men who operated the barges.

Different Ways of Expressing Grades.

The subjoined table, in which grades are expressed in three values, will be found convenient for reference. In the left hand column is given the percentage of a grade, advancing by one-tenth of one per cent., from 0.1 to 6 per cent., inclusive, which will cover all ordinary cases, although there are some few grades of a higher percentage where adhesion is depended on to haul the load.

The middle column gives the rise in feet per mile, and the right hand column shows the number of feet to one foot rise. With the upper line for an example, we have a grade of one-tenth of one per cent., and this is equal to five and twenty-eight hundredths feet per mile, and also equal to one foot in one thousand feet, or one in one thousand.

Such a table will be of great benefit to many who are not well up in the technics of grades, in helping to an understanding of the different methods of reference to the subject; to those it is specially commended. It will also be found useful by the engineer when making calculations, particularly those pertaining to traction powers of locomotives on grades.

Different Ways of Designating Grades in Equivalents.

Per Cent. of Grade.	Rise in Feet per Mile.	Length of Grade to 1 Foot Rise.
.1	5.28	1000
.2	10.56	500
.3	15.84	333.33
.4	21.12	250
.5	26.4	200
.6	31.68	166.66
.7	36.96	142.85
.8	42.24	125
.9	47.52	111.11
1.	52.8	100
.1	58.08	91.
.2	63.36	83.33
.3	68.64	76.92
.4	73.92	71.42
.5	79.2	66.66
.6	84.48	62.5
.7	89.76	58.82
.8	95.04	55.55
.9	100.32	52.63
2.	105.6	50.
.1	110.88	47.61
.2	116.16	45.45
.3	121.44	43.47
.4	126.72	41.66
.5	132.	40.
6	137.28	38.46
.7	142.56	37.03
.8	147.84	35.71
.9	153.12	34.48
3.	158.4	33.33
.1	163.68	32.25
.2	168.96	31.25
.3	174.24	30.30
.4	179.52	29.41
.5	184.8	28.57
.6	190.08	27.77
.7	195.36	27.02
.8	200.64	26.31
.9	205.92	25.64
4.	211.2	25.
.1	216.48	24.39
.2	221.76	23.8
.3	227.04	23.21
.4	232.32	22.72
.5	237.6	22.22
.6	242.88	21.73
.7	248.16	21.27
.8	253.44	20.83
.9	258.72	20.40
5.	264.	20.
.1	269.28	19.6
.2	274.56	19.23
.3	279.84	18.86
.4	285.12	18.51
.5	290.4	18.18
.6	295.68	17.85
.7	300.96	17.54
.8	306.24	17.24
.9	311.52	16.94
6.	316.8	16.66

Car Department.

CONDUCTED BY O. H. REYNOLDS.

A New Dust Guard.

The dust guard shown in our illustration is one devised by Mr. Thos H. Symington, M. E., Ass't Supt. of the Richmond Locomotive Works, who has given much thought to the need of a device that could justly claim the title of dust guard. It is extremely simple, and by its record in service furnishes flattering evidence not only of efficiency in excluding dirt from the journal but of staying qualities as well.

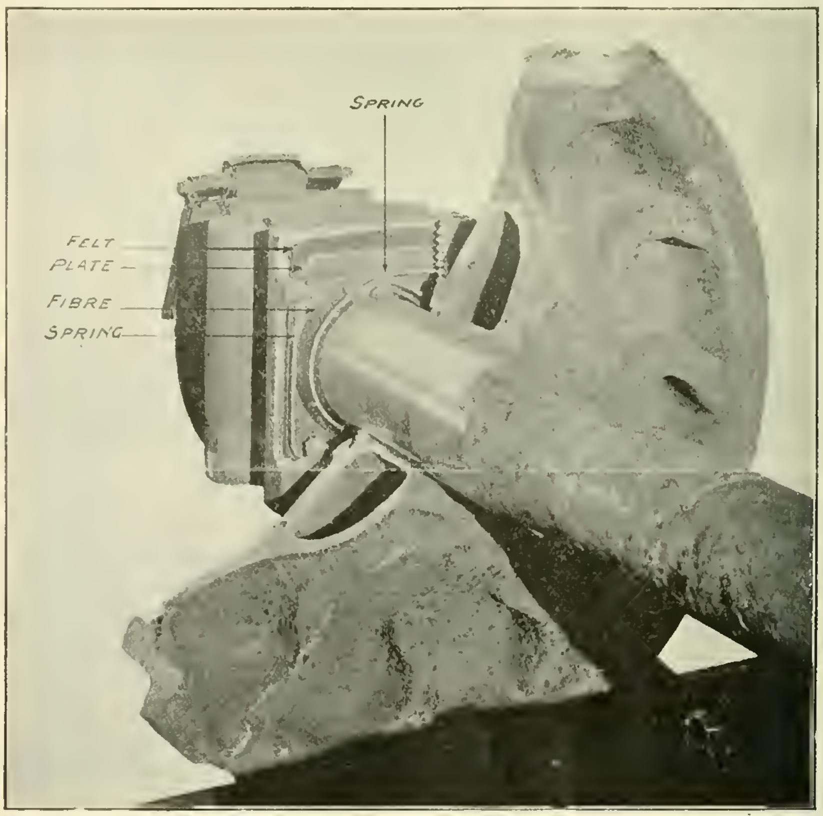
This dust guard is made of a combination of four pieces, namely, felt, a plate of 1-16-inch iron, a fiber ring and 1/4 inch steel wire spring. The felt is first put in the guard slot of the box, against the front wall; the iron plate having a hole through it 1-16 inch larger than the dust guard bearing is next placed against the felt,

SYMINGTON DUST GUARD.

and the fiber ring and spring are then put in place, the ring first being opened 1-16 inch by means of a wedge which is removed after the ring is in place in the box. A part of the spring is bent rectangular so as to remain in a constant position in the box, the object of which is to have the hooked end of the coil engage with the opening in the ring and hold the slot always at the top; this opening is two inches long, allowing the ring to close 3/4 inch in diameter as wear takes place. The spring bearing on the inclined face of the ring has the tendency of closing the ring and thus take up all wear between it and the axle. The iron plate meeting the axle on the opposite side of the opening in the ring, makes a joint that is tight at all points.

After 18 months' continuous running an examination of the axle failed to reveal any signs of contact by the parts; the hole in the plate showing only 1-64 inch larger than when first applied. The journal bearings were weighed before and after this test and a saving of 46 per cent. in wear was found over an ordinary dust guard on the same truck.

In the field of rolling stock engineering there has been few riper openings for intelligent experiment than along these lines. The miserable makeshifts used as dust guards, owe their existence to the fact that they cost practically nothing, and they will be hard to displace as long as the purchasing agent insists on putting the price of the freak against an article that is built on correct principles and cannot be made for nothing, because it is right mechanically.



SYMINGTON DUST GUARD.

Gages for Mounting Wheels.

At the meeting of the New York Railway Club, held February 18, 1897, there was an interesting and instructive paper read on the "Correct Method of Gaging and Mounting of Wheels," by Mr. George Tatnall; the paper showing clearly the disadvantages and troubles ensuing, with the present wide diversity from uniformity in thickness of wheel flanges, and also the danger to wheels and frogs by the cause named, as well as by the variable distance between inside of flanges.

There was no mention in this paper of another and equally important phase of wheel mounting, that is, the necessity of having the centers of the journals an equal distance from the vertical tangent of the throat curve in the flanges when the latter are brought to gage, but the text and also the discussion that followed was confined to the evil effects produced on frogs and guard rails, by incorrect dimensions between and over wheel flanges. We desire to call attention to the fact that the same direful results can be just as easily obtained with the so-called ideal conditions, as by the most hap-hazard pairing of wheels by flanges of unequal thickness and careless gaging.

This can be shown without a diagram if we take any distance, 4 feet 5½ inches between flanges, and 4 feet 8 inches between points of tangency, which will give a flange thickness of 1¼ inches at that point, a dimension that is in harmony with the Master Car Builders' standard wheel flange. If now the wheels are mounted in accordance with the above figures, and the distance between centers of journals is 6 feet 3 inches, we have a distance of 9½ inches from the center of each journal, to the tangent of the flange throat when the wheels are on the axle centrally with reference to the rail gage and centers of journals, and ¼ inch clearance between each side of flange, and guard rails spaced 1¾ inches apart.

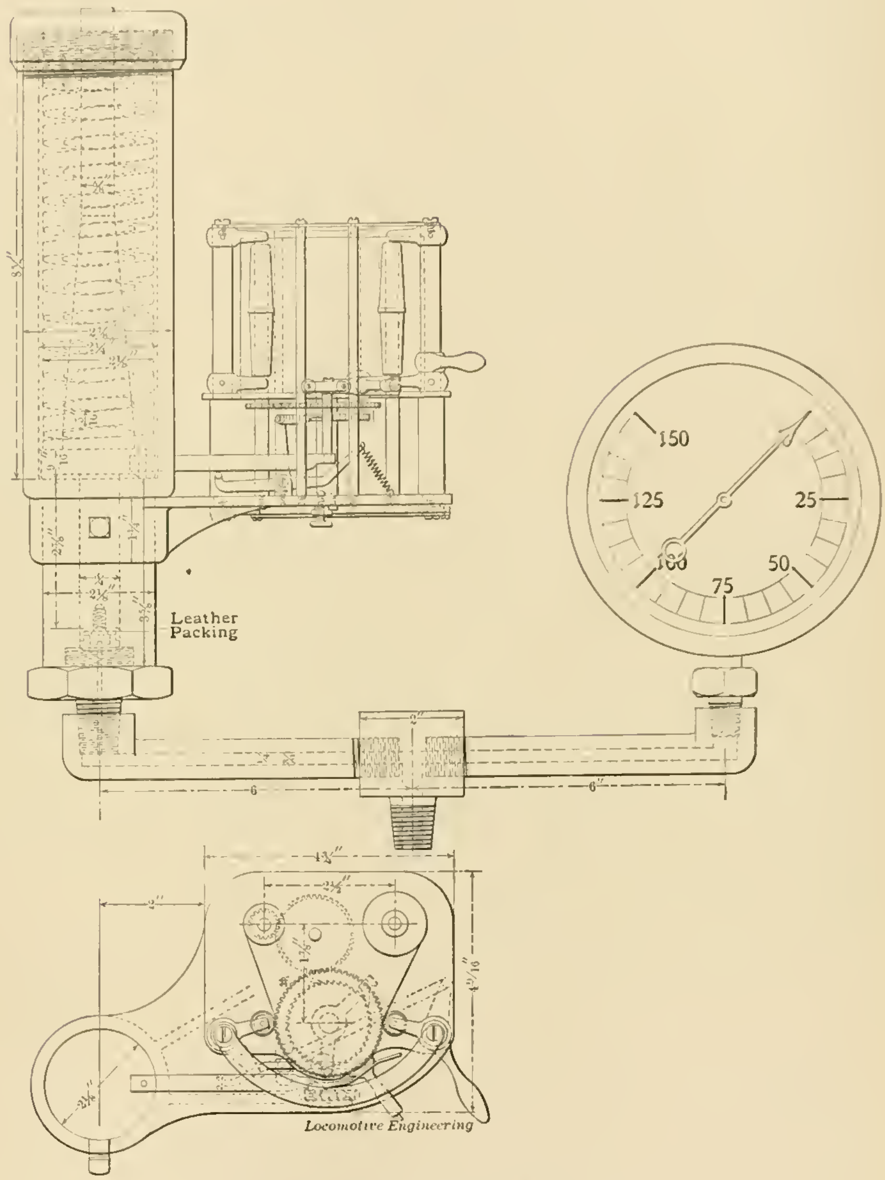
It is not difficult to see that the gage of these wheels can be 4 feet 8 inches and still measure 9¼ inches from the center of one journal to the point we have selected on the throat, and 9¾ inches from and to like points on the opposite wheel and journal. This status of things causes one flange to be away from the rail ½ inch and its mate to be against the rail, which conditions are "ideal" for a thin flange if it abstains from mounting the rail long enough to get the wear to reduce it.

Having once been called upon to diagnose a case of cut flanges, not so many years ago, we found an exact counterpart to the situation cited above, and the cost of treatment has since prevented a repetition of the malpractice on the road where it occurred. The M. C. B. Association have a recommended practice for "gage for locating wheels equidistant from center of axle," adopted by letter ballot in 1896. It is designed to take account of the point we advocate by getting the wheels central with the centers of the journals, working from the center of the axle. It is a step in the right direction, but it gages between wheels without regard to flange or track gage, which is the contrary to our holding, notwithstanding an edict from the M. C. B. Association has pronounced it the proper point to gage to. If there is any advantage in a given lateral clearance in reducing wear on flanges, then from the outside of the flange to the center of the journal are plainly the points to have in correct adjustment when mounting wheels, letting the small variation in flange thickness be provided for on the guard rail side.

Automatic Pressure Recorder for a Wheel Press.

One of the best of the late devices to hold in check the tendency to error ever present in press fits, is the automatic pressure recorder, designed by Mr. E. A. Williams, mechanical superintendent of the Minneapolis, St. Paul & Sault Ste. Marie Railway, and in use on the wheel presses of his shops at Minneapolis. By its unerring record the man who makes the fit between wheel and wheel seat is under constant surveillance; he can go neither beyond nor inside of the established limits for pressure, for there is a silent accuser that knows not how to prevaricate, and its story goes as a permanent record of all faults in the fit.

The arrangement is used in connection with the regulation gage for hydraulic pressures, and is mounted on the same pipe with the latter, so that the pressures are received simultaneously; aside from this there is nothing in common between the recorder and the gage. The recorder consists of a cylinder 2¼ inches inside diameter, which contains a helical spring $\frac{5}{16}$ inch square in section; the spring being seated on the top of a ¾-inch piston, which is seen to be flanged to receive it and which is in communication with the press ram by means of a $\frac{1}{16}$-inch hole. From the spring seat there is an arm extending out to the pencil mechanism of a Boyer speed recorder, moving the pencil as the spring is compressed or extended.



AUTOMATIC PRESSURE RECORDER.

Mounted on the two spools of the speed recorder is the usual continuous roll of paper, but divided into spaces representing tons and fractional parts of same, so as to give a registry in agreement with that on the gage. Movement is imparted to the paper by means of the arm that actuates the pencil, referred to above, and this is done when pressure is released from the ram, the spring then returning to its normal position in the cylinder, and when going down engaging with a lever which has connection with a pawl, and through it moving a ratchet and the paper, and preparing the latter for a new record. It is seen that the motion is an intermittent one, but it ensues at the right time and gives no opportunity to pad the returns. It is an ingenious device, and puts an old-timer in a reminiscent mood, recalling the shade of the old screw press with its hand levers and muscle for motive power; where the only gage tc determine when a fit was tight enough, was the ability of four strong men to pull the wheels on by their united efforts on the levers. Tin shims or center punching on the axle, alternating with draw filing and repeated trials, was the practice in getting a pair of wheels home. Split hubs sometimes showed up, but a loose wheel, never, and the man that could come nearest to the rupture and keep within the dead line, was regarded as little short of perfection with the calipers.

Early Motor Cars.

Since road motor carriages have been made more or less of a success within the last few years, there is an impression among many people that this is an entirely new form of transportation. In this connection, it is worthy of mention that in 1834 there was a line of steam road carriages run very successfully between Glasgow and Paisley for several months. There was nothing the matter with making the carriages a permanent success, except that the interests centered in horse transportation threw so many obstacles in the way of the steam carriages that they were finally abandoned.

These carriages were the most successful method of suburban travel in their day, for they made a trip of 7½ miles in 45 minutes, making stops wherever passengers wanted to get on. The horse omnibus men dealt very unfairly with the steam carriages, and threw rocks and other obstacles on the road to cause accidents. In this they were finally successful, and a steam carriage was overturned, which caused the death of one man. The Court of Sessions, a most conservative body in Scotland, were opposed to anything that savored of progress out of the beaten track, and they made the accident to the steam carriage an excuse for ordering their employment to be stopped. That ended for the time a very promising method of improving suburban transportation.

Compressed Air in Painting Railway Equipment.

The meeting of the New England Railroad Club, of February 9th, was one of special interest to the car painter, and will be spread on the records of the club as one of the most profitable sessions of the organization, for the reason that the information brought out is not based on opinion, but is the practical result of investigation by masters of their profession, to determine if there was economy in the spraying of paint as against brush methods.

All of the papers read on this topic were of the ablest possible character. We quote from that of Mr. W. O. Quest, Master Car Painter of the Pittsburg & Lake Erie Railroad, who has thrown a strong comparative light on the saving to be effected by the spray process.

"The theme of our paper is to be based upon the giving of our, practical experience; wherein we are to state in detail the advantages, if any, the economy of practice, the possible future scope of practical uses, etc., where utilizing machinery, operated with compressed air, versus the paint brush on certain grades of work in the railway car painting departments. As an associated railway foreman of car painters, we claim to assure you that it affords us a great deal of satisfaction to be in a position to respond to your call for data on a matter which, we think, in the near future will prove both important and interesting to those who are in an official way identified with the business of car and locomotive painting.

"In our version we will endeavor to demonstrate to you, through backing up our statements with vouched-for figures, that the claim that paint can be sprayed on work in a first-class manner without the use of the brush is not the flight of an enlivened imagination, but it is an actual, practical fact, which time will prove. Time and investigation will prove that with a perfect atomizing device, the special classes of work executed with it will equal, if not surpass, that done with the brush, especially when compared with that applied on work with the brush, and where cheap labor is employed and done under hurried methods commonly practiced to-day. Investigation will also prove that where paint is thoroughly atomized, it is possible to show a saving of material over that of the brush practice.

"We are also ready to assume the position that a heavier bodied coat of paint cannot be applied with the brush than can be put on with the spraying machine; from the fact, if it be so desired, the syphon sprayer can be made powerful enough to lift and perfectly atomize either a lead or metallic mixed paint weighing 16 pounds to the gallon, without detracting from the appearance or drying qualities of the work; in fact, will, in our estimation, look better than hurried painting done with the brush, where using a similar heavy-bodied paint, which under such circumstances is rarely, if ever, brushed out.

We will further call your attention to the fact that a perfectly atomized spray on paint will almost instantaneously reach, cover up and consequently protect a car's most complicated structural parts. It penetrates the rough beaded work, the open joints through shrinkage of the sheathing, the crevices and other disfigurements usually met with where painting the new and repainting the old railway freight-car equipment. In refutation of existing doubts in circulation, we will ask you to accept the evidence of the close observation made by us from time to time, of some sprayed freight cars and other large surface work done by the Pittsburg & Lake Erie Railroad Company, in the beginning, convincing us that the results from a standpoint of durability will not suffer on the score of the fact that the paint was not applied with the brush.

We will also advance the theory that we will be safe when we express the belief that the operation of a perfect atomized painting apparatus will not injure the health of the operator, if the proper precautionary measures are taken. The safeguard we would suggest against this possibility is to use nothing but a perfect atomizing device, which should be worked to its full capacity with a sufficient air pressure to force the paint clear of the nozzle on the work without dripping. The much objected to white spray, which is always perceptible during the spraying operation, will on investigation prove to be nothing worse than volumes of discharged surplus air, which becomes vaporous on forced release, from the fact of air being so much lighter than the heavier atoms of paint which is ejected with great force ahead on the work, and not back, as has been claimed, in the face of the operator.

This being the fact, we would judge there need be no danger apprehended in a health sense, through the use of the pneumatic paint sprayer when properly operated. Deeming the above summary a sufficient introduction for the paint-spraying issue, we will now proceed to take up the question of the comparative cost of paint used, the utility of the innovation, etc. Following is the cost of the work done in the Pittsburg & Lake Erie Company's freight yard during the period the spraying appliance was in operation. We will compare the time and labor cost of sprayed work with that of time and cost of work done with the brush, when employing labor under the piece-price system:"

TABLE OF COMPARATIVE COST, AND PERCENTAGE OF GAIN.

Cars.	Piece Work.		Spray.		Saving.		
	Hours.	Cost.	Hours.	Cost.	Hours.	Cost.	Per Cent.
Box	3½	.60	¾	.15	2¾	.45	75
Coal	1½	.30	¼	.10	1¼	.20	66⅔
Coke	3	.50	½	.12	2½	.38	76
Flat	½	.10	1/6	.05	1/6	.05	50
Trucks—all Cars	...	.30	...	.12	...	.18	60
Roof only—Box	...	.10	...	.04	...	.06	60

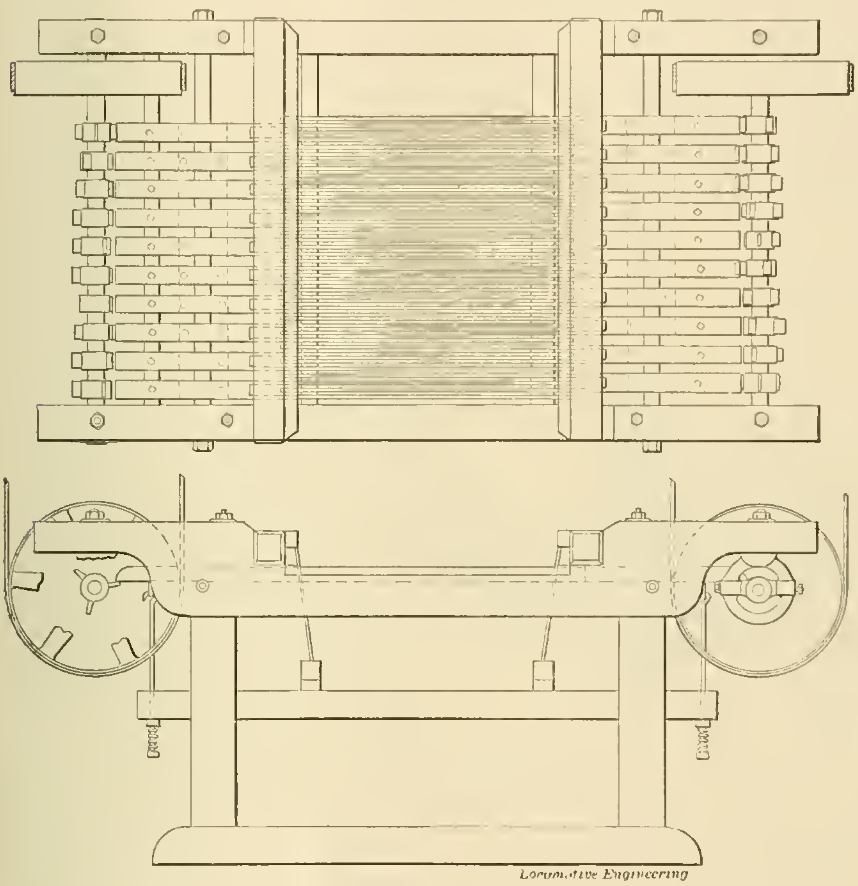
This excerpt from one of the live papers on the subject affords the proper data from which to judge the actual worth of a proposition. The dollars and cents in the table are the factors that count in the problem, and the results illustrate the value of club work when pitted against individual effort.

A Car-Seat Dust Extractor.

One of the best devices for getting dust out of a car seat and frame is shown in the engraving herewith. It is one of Master Mechanic Stewart's schemes at the Huntington shops, original there, and, as far as we know, not in use on any other road than the Chesapeake & Ohio.

It consists of a wooden frame gotten up on the general lines of a saw table, except that it has an open top, which is filled in with a series of wooden bars 1¾ inches square, which are supported on a cross-bar at each end of the machine, and each bar held down by a small coiled spring. On top of the bars is a fine slatwork to carry the seat and frame.

There is a pulley at each end of the machine, actuating a shaft on which is placed a series of small collars having three lugs of equal length on the periphery, whose province is to kick the bars and seat upward, and cause as much unrest in the mechanism as possible. The collars are placed on the two shafts so as to time the raising of the bars with an utter disregard to uniformity of movement, as will be seen by reference to the engraving. The motion is decidedly serpentine, and is likely to cause sea-sickness to any one who tries to trace its devious ways, but it knocks the dust out of the seat and springs, and thus accomplishes the purpose for which it was built.



DUST EXTRACTOR.

Standard Hight of Drawbars on Freight Cars.

The fog that has long enveloped the exact import of the instructions referring to the hight of drawbars, as named by the American Railway Association, has at last lifted, as will be seen by the following circular under date of February 23, 1897, recently received from Mr. Edw. A. Mosely, secretary of the Interstate Commerce Commission, Washington, D. C.:

"Attention having been called to an apparent misunderstanding among many of the carriers engaged in interstate commerce as to the precise meaning of language used by the American Railway Association, acting under authority conferred by section 5 of the Act of March 2, 1893, in fixing the standard hight of draw-bars, and the variations to be allowed therefrom as between empty and loaded cars, the Association has, at the suggestion of the Commission, stated its understanding in regard to the standard hight of drawbar required for freight cars of standard gage to be as follows:

"The standard hight of drawbars for freight cars measured perpendicular from the level of the tops of rails to center of drawbars is 34½ inches, with no greater variation allowable than 3 inches, minimum hight 31½ inches. By center of drawbar is meant the horizontal line through the center of the drawbar shank. Thirty-four and one-half inches is the standard hight, from which there can only be a variation of 3 inches downward.

"This accords with the interpretation hitherto announced by the Commission, and any departure from this standard is a failure to comply with the law."

A Box Car as a Dry-Kiln.

A dry-kiln for lumber was badly needed at the Chesapeake & Ohio shops, Huntington, W. Va., and all requirements were met by taking an old 40,000-pound box-car body and utilizing it for drying purposes.

The car is fitted with 1¼-inch steam pipes, laid on the floor; upon the latter, lumber is piled to the full capacity of the car body, and steam turned on. It requires about two weeks to put a carload of lumber in a passable condition for the mill. This furnishes a most convincing lesson in expedients, that cannot but be of use to others similarly situated, provided a steam supply, adequate to the demand, is available.

No Right to Make Patented Articles.

An impression prevails largely that any one has the right to build or make a patented device for his or her own use, but it is not needless to state that this is erroneous, for very many persons have done, are doing, or contemplate doing this very thing. A machinist sees, for example, a tool, large or small in a supply store and finds that the price is more than he wishes to pay. He takes a mental note of the device and makes one himself, with the mistaken view that as it is not sold by him, or offered for sale, he does not infringe upon the patentee's rights. He does, however, and is liable to the inventor and to the law for royalty and trespass. Suppose, as is often the case, an inventor contrives some simple affair which is of great utility in domestic affairs and can be made readily by anyone in a short time. It is easy to see that in a large city, hundreds of persons may make the device for their own use, thereby depriving the inventor of his privilege. Do not meddle with patented devices in any way, either by imitating or actually constructing them. It will be found expensive if the infringer is detected.—"The Engineer," N. Y.

Clinton B. Conger, traveling engineer of the Chicago & West Michigan Railroad, and the author of the well-known little book, "Air-Brake Catechism," has revised this book and added sixteen pages. Mr. Conger's catechism plan has done a great deal to familiarize engine and trainmen with the brake apparatus, and we are glad to see that the new edition is the twelfth thousand of these books sold.

Practical Letters from Practical Men.

Locomotive Boiler Tools.

Editors:

The sketches inclosed herewith represent some tools we have devised for boiler work. Fig. 1 shows an adjustable tool for boring flue holes in flue-sheets. In the construction of this the best tool steel is used, and the bar *A A* is turned as in Fig. 2.

Two $\frac{15}{16}$-inch holes *B B* are next drilled opposite each other to a depth of $\frac{3}{16}$ inch and two grooves are then planed or milled to receive two pieces of $\frac{7}{8}$-inch square

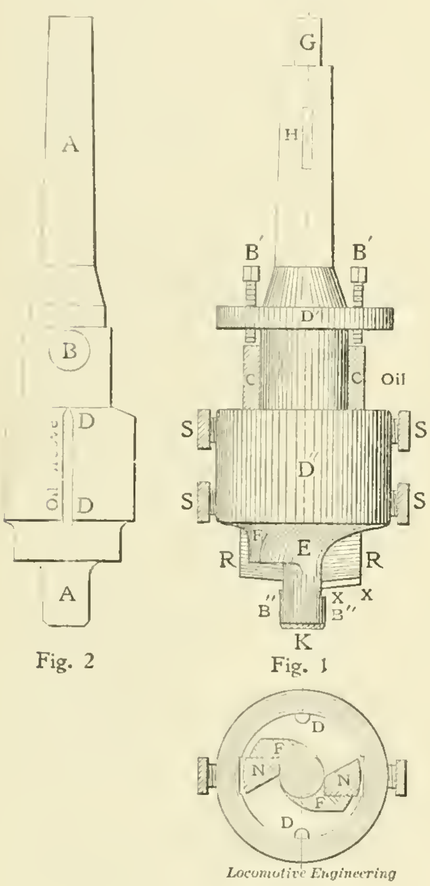


Fig. 2 Fig. 1

BOILER TOOLS.

steel for cutters which are applied in the rough, as shown at *C C*, in Fig. 1. Two oil grooves are put in at *D D*, Fig. 2. Part *E*, Fig. 1, is chipped and dressed down for clearance, leaving *F F* on opposite sides to act as shoulders for the cutters *R R* to bear against and prevent chattering, bending or breaking while in operation.

Parts *G H* and *K*, Fig. 1, are finished, and the end *K* is hardened, after which the collars *D'* and *D''* are shrunk on and the tool given whatever finish is desired. The cutters are fastened by the set-screws *S*. The ends *R R* are turned about one inch in length and to the required diameter, after which they are finished by grinding, as shown in the sectional view at *N N*. They are made with a slight bevel at *X X*, so as to start a cut under any scale. The screws *B' B'*, through collar *D'*, are for adjusting the cutters to an equal depth. Extra cutters of variable diameter fit the same head, making it an easy matter to change from one size to another. The holes in flue sheet to receive the tit *K* must be sized by a reamer, so as to have a fit at *B'' B''*. This tool acts in operation much like a twist drill; takes a good cut and keeps to size. It has never given the least trouble.

Fig 3 is an adjustable tool for dry-pipe holes in the front flue-sheet. The bar

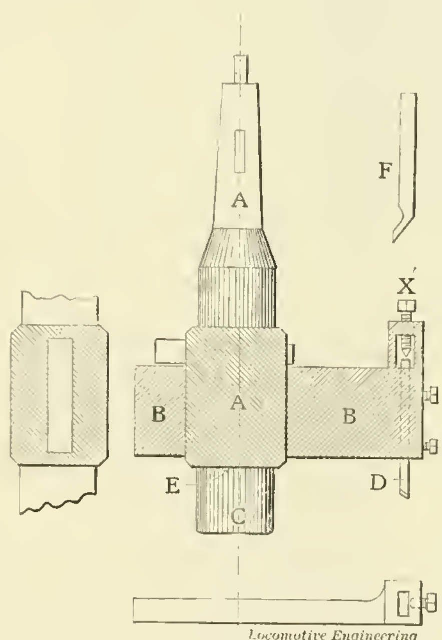


Fig. 3

BOILER TOOLS.

A A is cast-steel, and the sliding piece *B B* is made of axle steel. The sketch explains its construction. To use the tool, a 2-inch hole is drilled in the flue-sheet to receive the tit *C*, after which a groove is cut to the diameter of the dry-pipe with the cutter *D*, but not quite through the sheet; the cutter *D* is then removed, and the bevel cutter *F* takes its place. The boring-bar is then let down with *E* close to the sheet, so that all lost motion is taken up between *E* and the top of drill-press spindle. The sliding piece *B B* is then adjusted and the bevel tool put in operation by feeding down the cutter *F* by hand, by means of the set-screw *X*.

By handling the tool as described, the cutter will make a nice clean and smooth bevel seat to receive the dry-pipe joint. After this is made, the cutter *D* replaces the cutter *F*, and the groove is cut until the center blank drops out, and thus finishes the hole.

J. A. Eisenaker.

Elmira, N. Y.

Joy's Valve Gear.

Editors:

I have seen a letter in your issue of January, 1897, signed C. E. Stretton, which has been repeated in some of the papers here, but of which I do not consider it worth while to take any notice, as the real facts are all quite well known here, and the animus which has prompted this and other letters is too evident, so that they go for what they are worth. But in your country where these matters are not fully known, I do think it worth while to deny totally the statement of any failure of those ten Midland engines, and you will get the same positive denial from Midland Railway headquarters if you wish to know the truth. Of course I can answer you on the facts, and not by random and unsupported statements.

These ten engines are 10 out of 3,000, and are now comparatively old engines, and as a matter of progress have been superseded by a newer and larger type of big single engine, 7-6—7-9 wheels, which class are very much employed for running our heaviest and fastest traffic, the newer engines always taking the precedence. But when these ten first came onto the line, and with the standard 4-coupled ran the Scotch and the Nottingham trains, the fastest and heaviest on the line, I often ran on them and saw the miles rolled off continuously in 50 to 51 seconds, etc. With these trains these engines were burning only 24 to 26 pounds of fuel per mile. I don't think your practical men will call that failure. Both load and speed up to anything in the country, and this consumption unsurpassed. But for a sample of the big single type —a run with one of Mr. Worsdell's is given in the "Engineer" of March 7, 1890, wheels 7-7¼; train, total with engine 310 tons, reached a speed of 86 miles per hour—and the average consumption of that class is but 26 pounds per mile.

I only wish your countrymen, with whom I spent such a good time a few years ago, could be over here to see the work my type of engines are doing in this country. Why Stretton, in his bitterness about the ten engines, has forgotten the 3,000 everywhere else, and probably knows nothing of the 500,000 horse-power of big engines at sea. I can well trust the reputation of my system with your countrymen, and hope some of them will be here for the Jubilee, as well as the naval architects who are coming.

David Joy,
Of David Joy, Son & Pryor.
London, Eng.

Feed Water Heater.

Editors:

As an item of interest to everyone concerned in the economical use of fuel in locomotives, I take pleasure in sending to your address this date print showing application, plan and details of my feed water heater, as applied to locomotives. I shall be glad if you can in any way make use of them for your valuable journal. They are self-explanatory.

The purpose of the separator shown is to dislodge any oils or foreign matter which would otherwise be carried into the boiler through the feed water. It can be readily blown out two or three times a trip, as occasion may require. The use of this device is merely precautionary.

The feed water heating arrangement is very simple: A three-way valve in front of pump, a lever controlling direction of exhaust, putting it into stack or into tank and vice-versa; a 1¼-inch pipe running in both directions from the valve to stack and from valve back into tank through the separator, and steam hose and connection, as shown by print. Around the bottom of tank lies a 2½-inch pipe, with fifteen upright pipes with Tee connections, all of same dimensions as horizontal pipe mentioned. At the end of each vertical pipe is a goose neck attachment with a reduced nozzle ⅛-inch in diameter, except the last one at the end of the horizontal pipe, which has a nozzle attachment of 1 inch in diameter. The object of the larger opening in the one pipe is to induce the exhaust to follow the horizontal pipe to the end, carrying with it the condensation falling from the other upright pipes with the smaller openings, which smaller openings are for purpose of assisting in giving vent to the exhaust and keeping uprights heated. Should the water become too warm for the injector, the operator easily turns the exhaust into the stack. The water in tank can be heated to 100 degrees Fahr., and more. Any injector of modern make will readily work at that temperature. As the water recedes in tank, note that less heating surface is in contact with water, hence the tendency is for the water to remain at even temperature.

There is no question as to great results from this device as a fuel economizer. Then, again, its practical utility in diverting the steam pump exhaust from the front end into the tender is simply getting rid of a nuisance at no expense, and putting it where it is of real benefit, in addition to the great saving in fuel.

This invention is patent applied for, and already quite a number of roads are arranging for its adoption.

J. B. Barnes,
S. M. P. & M., Wabash R. R.
Springfield, Ill.

Treatment of Employes on Russian Railways.

Editors:

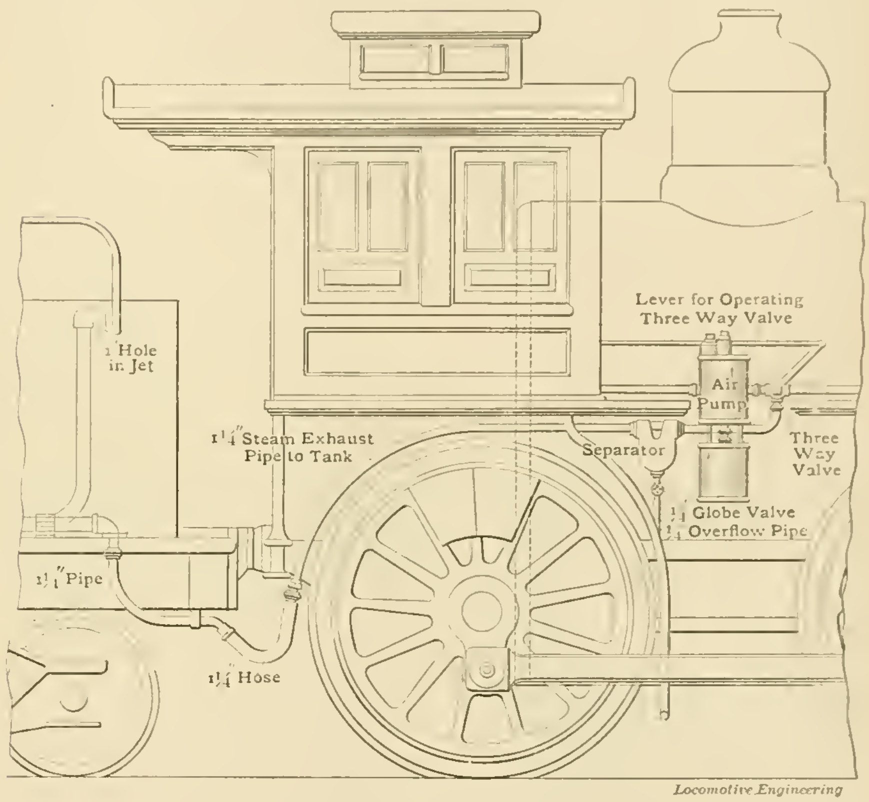
As one who was for several years actively engaged in the motive power and machinery department of the Nicolas and other Russian railways, I have read with much interest the article on "Russian Railways," written by Mr. W. J. McCarroll, which appeared in your February issue.

For many years Russia has been a good field for mechanical engineers and foremen in machine shops and foundries, and, no doubt, will continue to be so for some time to come; but it can offer no inducements to enginemen and trainmen equal to those they enjoy in this country. The language, which is of course essential to anyone doing business in the country, is difficult to acquire, and but few foreigners learn to speak it with accuracy or fluency.

As to the treatment accorded to employés on Russian railways I can, from personal experience, say much in its favor. Many of the railways, in my time, were most liberal in the distribution of bonuses. Good dividends to stockholders meant good times for the employés. On the Nicolas Railway (the Pennsylvania Railroad of Russia) there was a standing rule for the payment of every other year to each faithful employé, in receipt of monthly wages, a bonus equal to two months' salary; and also another rule, which entitled all such on quitting the service, or being retired therefrom, to receive one month's salary for every year of service rendered. I should add that all, or nearly all, outside of mechanics and laborers, came under the rules mentioned.

Mr. W. J. McCarroll speaks favorably of Russian passenger cars on the whole, but complains of their poor ventilation and lighting. He seems to have overlooked the fact that the cars on the Nicolas Railway are lighted with gas. As far back as 1878 the cars running with fast trains on that road were equipped with the "Pintsch" system of gas lighting.

Thos. A. Pudan.
Sacramento, Cal.



BARNES FEED WATER HEATER.

The Heaviest Locomotive.

Editors:

Are you not mistaken in stating on page 221 in the last issue of the "Locomotive Engineering" that the new Northern Pacific twelve-wheelers are the heaviest locomotives ever built? Did not the Baldwin Locomotive Works build for the N. Y., L. E. & W. Ry. four decapod locomotives, which were compounds on the Vauclain plan, the weight of each engine being 193,000 pounds, and the weight of the tender, with coal and water, 90,000 pounds, and the weight of engine and tender in working order, 283,000 pounds?

The weight of the Northern Pacific twelve-wheeler—that is, engine and tender—is 267,300 pounds and the weight of the N. Y., L. E. & W. decapod, engine and tender, 283,000 pounds; the difference between the two being in favor of the decapod, 15,700 pounds, of which the engine is heavier by 7,000 pounds.

Sioux Falls, S. D. C. F. SUNDBERG.

Locomotive History.

Editors:

Your very interesting paper for February has arrived here to-day, and I have very carefully examined the charts of the old engines. The "James" link motion, of 1832, is remarkably clearly shown, and will probably astonish some of your English readers. When I returned from Chicago in 1893 and stated that the "link motion" was an American invention, I was very strongly abused by one or two writers upon this side of the Atlantic.

I fully agree with your view, page 150, that the Railway Museum in England should have been started years ago; however, when eleven years ago I suggested the museum, I could not get English railway companies nor engineers to take any interest in the subject.

As a matter of fact, the finest collection of English railway history ever made is, unfortunately, not in England; it was at Chicago, 1893, and is now at the Field Museum, Chicago. As an Englishman I wish we had the English part of the Field Museum in London. At Chicago there are original books, drawings and details of railways which we in this country have lost to history. If we require to trace the history of the firm of Bury & Co., of Liverpool, or of Wilson & Co., of Leeds, or to ascertain the dimensions of some early Great Western engines, we have to refer to copies made from the originals now at Chicago. Probably you, sir, may have observed that from time to time one or two correspondents have attempted in some of the English papers to speak of the splendid Chicago collection as not genuine; however, as I traveled 8,000 miles in order to inspect it, I can say, without any fear of contradiction, that it was the most complete record of English locomotive history ever exhibited.

I have also ascertained that some of your American railroad companies have some very interesting links in history. For instance, the drawing of Bury engine "Liverpool," 1831, is framed at the office of the old Petersburgh Railroad Company, yet in this country there is now no original drawing of it; and with the exception of some notes made by myself, the records of Bury & Co. are lost to England. I thank you for your good wishes for the success of my museum suggestion.

CLEMENT E. STRETTON, C. E.

Leicester, Feb. 18, 1897.

A Curious Lubricator Disorder.

Editors:

I am running an engine equipped with a Nathan sight feed lubricator, and it is my custom when standing at stations to close water-valve instead of shutting off the feed. As water valve is not entirely tight, lubricator will not stop entirely, but feeds very slow. Engine was recently held in for a week for boiler work, and on taking her out I noticed when shutting water-valve that left feed would stop entirely, while right one fed just about the same as when water-valve was open. I was very much puzzled at first, but soon discovered the cause, which was as follows: When the engine was held in, she stood outdoors two days dead, and the lubricator feed-glasses froze up and bursted and the man who replaced them failed to clean out all the fragments, and a small piece of glass got stuck in the left choke plug, making it much smaller than the right one. While waiting for a train I disconnected oil pipes and opened steam-valve, and as steam did not come from the left choke plug as freely as the right one, I took out plug and found the glass as described. After removing it, lubricator was O. K.

Basalt, Col. J. W. KALFUS.

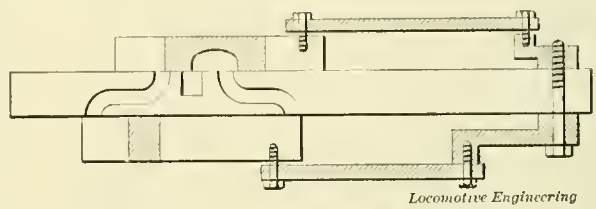
A Cheap Valve Motion Model.

Editors:

Engineers and others who wish to become familiar with valve and piston motions, and their relation to each other in the common slide valve engine, will find in the simple contrivance shown in the accompanying sketch, an instructor that will teach them more in ten minutes than they can learn from books and diagrams in long study.

I have made several of them myself during the past few years, and therefore speak from experience. Almost anybody can make one in a few minutes. The two cranks should be made of hard wood, to prevent the shaft from working loose in them, but the other parts can be made of pine. A large wire nail makes a good driving shaft. The small crank will, of course, give exactly the same motion as an eccentric of like throw.

The piston, valve, and ports, are drawn on the surface of the parts. The relative positions of the valve and piston can be seen at any part of the stroke, and the effect of the larger angle described by the crank and the main rod, on the speed of the piston at the beginning of the stroke from the head-end of the cylinder, will be plainly understood, and also the reason why greater lead on the crank end will equalize the unequal cut-off produced thereby.



CHEAP VALVE MOTION MODEL.

Those who are still bewildered by the strange discussion on this subject, with which we were afflicted a few months ago in some of the engineering journals, should lose no time in making one of these little models if they wish their minds to return to their normal quietude.

W. F. CLEVELAND.

Moncton, N. B., Canada.

Expeditious Locomotive Building.

Editors:

Referring to the item on page 168, entitled "Time necessary for building a locomotive," in your issue for February, we make some pretensions of rapid locomotive construction ourselves; for instance, November 2, 1895, we received an order for a 17 x 24 6-wheeled connected sloping tank switching locomotive weighing 81,000 pounds, and on November 25th we shipped the locomotive complete in every respect. We had the drawings and patterns, it is true, but had to procure the material.

May 8, 1896, we received an order from the Southern Railway for six 20 x 26 consolidation locomotives weighing 140,000 pounds. On June 19th we shipped the first engine of the order, having had to make a complete set of patterns for every detail from the Railway Company prints.

April 30, 1895, we received an order for five 19 x 24 moguls weighing 121,000 pounds from the Missouri, Kansas & Texas Railway, and on June 4th we shipped the first engine of the order, having had to make a complete set of drawings and patterns for every detail from Railway Company's prints.

We mention these circumstances for the reason that your article above referred to is going through the daily press stating what the Baldwin people did on their first Russian order, and we think any one of the instances above referred to superior to that of the Baldwin, for the reason that they built engines of their own design modified somewhat in accordance with Russian practice, but nevertheless the standard engine of the Baldwin Locomotive Works.

BROOKS LOCOMOTIVE WORKS,
By R. J. GROSS, Vice-Pres't.

Dunkirk, N. Y.

Priming Due to Salt in Feed Water.

Editors:

I would be very much obliged if you could give me a little information as to how to prevent an engine from priming, when the boiler is dirty, or is using water mixed with salt, the latter being caused through the tanks being filled with river water at high tides in the dry season.

If there is anything which you or any of your numerous readers could recommend to remedy this annoyance of priming caused in this way, it would be very useful to many readers of your paper. The priming is so very bad, that the gage glass may show a full head of water, which completely disappears when steam is shut off. With fast trains, it is impossible to keep time when a boiler is in this condition and causes excessive priming. I trust that you can recommend something to help us in this difficulty.

W. Savigny.

Howrah, Bengal, East India.

[We do not believe that any remedy can be given for boilers priming, when they are loaded with dirt or have salt or alkaline matter mixed with the water. All sorts of appliances have been tried in the alkaline districts of this continent, without success. The only remedy is frequent washing out, a large boiler, with ample steam and water space, and a careful, patient engineer.—Eds.]

Defective Dampers—Waste of Coal by Reckless Firing.

Editors:

I went over to talk to my old friend Smith. They were on the siding waiting for the Flyer to go past. I noticed the "89" had both dampers wide open, blower working full, and steam blowing off at pop. Fireman was putting in a big fire. Replying to a question, if the flues were leaking, he said, No, but he had to keep ready; while he had engine hot he was not going to take any chances by letting the fire get low. He said nearly all of them fired that way, that by leaving the door shut, dampers open and blower working at stations and other places where throttle was shut, steam could be held up with less bother when the throttle was opened again. He said, "We never trouble ourselves about closing dampers—too much bother; most engines have dampers on when coming out of shop, but the firemen pull them off or fasten them open. Engines make more steam if dampers are off; besides, few dampers fit right or work easily." He said they took all the coal that could be put on the tender at each coaling station, and if any of it was left over at end of trip, the hostlers were pretty certain to use it all up during the night. After they cleaned fire they would run engine into house and forget to close dampers, if engine had them on; they would leave blower working for an hour or two, and then come around and put in a lot more coal and hook up the fire, and engine would blow off steam nearly all night. Fireman said he had known some hostlers to use fifty bushels of coal while tending fire for twelve hours.

He told me the engine was not steaming good lately, and Smith reported, "Engine not steaming." Roundhouse foreman had a bushing put in the nozzle. Fireman thought the "89" hit the fire too hard next flues, and he told Smith to report diaphragm raised a little. Roundhouse foreman read the report, tore it up, and ordered hostler to fire the thing up. The Flyer having passed, Smith pulled out of siding, and I returned, musing over what the fireman had said about the dampers, his ideas of firing, and thinking there are others like him—seat-box firemen—they destroy six to eight tons of coal per thousand miles unnecessarily, by big fires, careless firing, using blower and complete disregard of dampers. As regards dampers, how many engines have dampers that are entirely useless; not put up carefully. If all right coming out of shop, soon Mike, Heinrich or the Dago, as the case may be, when about to clean fire, looks around for a piece of rail, or heavy poker, and, putting it in between the spokes of wheel, under corner of damper, pries it wide open with as much force as though it weighed half a ton. It would require dampers made of armor plate, almost, to stand the onslaughts of those fellows. I have long been of opinion that dampers ought to be made of some stiff material that would not bend easily.

Some firemen will come around nearly two hours before leaving time, and stir over the fire and put on blower and use up a half ton coal and blow away a foot of water out of tank before starting time. I have noticed firemen that would not let pop waste steam oftener than three or four times in a distance of seventy-five miles, while others would have pop blowing an hour or more before leaving, and at every station and shutting off point over the division. As a rule, the man that kept the pop down had more steam when it was needed than the other, because he did the work more intelligently, reserving his coal pile and clean fire as much as possible where he could, and not using so much water, had a cleaner boiler and a more free steaming engine. The other man would keep a big fire in all the time, and, if engine did not burn it, he would hook the fire over, and use up half a ton too much coal, and have a dirty fire before half way over the division. Then, if engine did not steam good with such treatment, he would complain that it was a poor steamer, used too much coal, etc.

There ought to be a complete co-operation between engineer and fireman, a mutual interest in all things relating to the best methods of firing and handling the engine. The engineer should take an interest in the duties of the fireman, and fireman should obey strictly, promptly and cheerfully, the advice and instruction of the engineer. Firing or handling the locomotive of a heavy fast freight or passenger train, is hard work, and requires men of correct habits, good judgment and carefulness. Most of the worry may rest with engineer, but the fireman does not escape. If the train is extra heavy, rail slippery, flues or firebox leaking, coal bad quality, train late, heavy storms of snow or rain, watching every point to make up a minute where possible. Under all these difficulties, engineer and firemen have the grief pretty evenly divided. Meanwhile, if on passenger, the conductor may be sitting on a nice soft seat, in center of a parlor car, his polished boots resting on a foot rest, while he leisurely looks over the sporting column of the morning paper. When train rolls into depot on time, he will get down and take nearly all the credit unto himself, or should you come in late, he may walk over to engine and ask where did we get laid out this trip.

J. J. Clair.

Pittsburg, Pa.

Help in Noticing Things.

Editors:

I was much interested in the article in the March issue, on "Noticing Things," and thought the little trick of the Professor's was a very happy thought to illustrate the point, but in reading along further I noticed a thing myself, which was, that the roundhouse foreman must have been blessed with more than ordinary perception to have reasoned the thing out as he did, viz., that because the cross-head had rather more than ordinary clearance at the ends of the guides, that there must have been a thinner piston in the cylinder, and consequently more clearance there. All the thinner piston head would do, so far as the travel is concerned, would be to wear shoulders in each end of the cylinder, because it would not travel over the counterbore, and if its striking points were marked on the guides they would be further apart, or, in other words, show more space between them and the crosshead at the ends of stroke. The crosshead will travel the same distance at each revolution of the wheels, so long as the main rod is up and properly connected, no matter whether there is a piston in the cylinder on that side or not. He certainly did not have the striking points to figure from, because the account says, "an idea struck him," and he told the machinist to find them, etc.

This subject of ideas and where they come from is a very large one, and I doubt if a satisfactory description of it can be given, but it is a fact that many ideas that turn out all right are in the inception based on false premises, and during the carrying out of the original idea new ones come, so that we almost unconsciously drift from the original wrong one into a right and successful one.

To illustrate, and it may have been this way, the foreman, as above, may have been looking around the back shop when this engine was in, and among other things seen the new pistons lying around and the old ones close by, in which case about 1¼ inches difference in thickness would be very noticeable to almost anyone. He very likely only saw the pistons, and three weeks afterward would have taken oath he never saw them. However, the impression remained in his mind, and seeing the extra space at the end of the travel of crosshead as before mentioned, the hazy remembrance of the thin pistons in the back shop came to mind, and then by a system of false reasoning he thought possibly they may have caused it, when really they had nothing to do with it; but, in trying to find if they did cause it, he found they caused excessive clearance, which very likely was mentioned to the master mechanic, and he saw the bad effects of it, because everyone's attention had been drawn to the bad performance of the engine since she came out, but he would very likely not have thought about the clearance if everything had gone along passably well.

C. S. BEACH.

Bennington, Vt.

That Fighting Engineer.

Editors:

In the perusal of your January number, a piece attracted my attention, which was entitled "The Fighting Engineer." Finding myself the principal character of the piece, I take the liberty of asking space in your valuable journal to reply to Brother Warman; not for the purpose of endeavoring to justify my actions on the several occasions which he narrates, for I did a great many things as a boy, aye, and as a man, too, for that matter, which, in these days of experience and maturity, I cannot but look back upon with regret.

That the blame for a certain amount of viciousness, as a young man, may not fall on innocent shoulders, a word or two in regard to my antecedents and childhood's surroundings may not be out of place. I was born in Jackson County, Tennessee, my father being a native of the same county, and an old and respected citizen thereof. My mother (God bless her memory!) was a daughter of James Pharis, of Jackson County; a good Christian woman of the Methodist faith, whose greatest wish was to see her children safely enrolled under the same creed.

In 1871 the desire to make my own way in the world became so great that I ran away from home; but even in taking this premeditated step, Christian influence asserted itself, and, kneeling beside the grave of that dear mother, I asked God to guide my footsteps and make me a man, and to aid me in my efforts to make my own living, that I might not be dependent upon others. There at mother's grave began my battle of life. In my many wanderings I have made firm and fast friends—friends whose love has helped me—but the precepts and prayers of my mother have helped me more than all else.

Leaving the old home, I walked to Caneyville, Ky., where I worked for Mr. S. W. Bond, my present father-in-law, for some time; thence journeying Westward, in 1877 to 1879 I was engaged on the ranges of Colorado, Kansas and Texas, when my railroad career commenced, my initial position being on the Denver & Rio Grande, where, as Brother Warman says, there is not a man who does not know John Jones, either personally or by reputation. However, among all these there is not one who can truthfully say that they ever saw the "hero" (if such encounters are heroic) of the episodes narrated, under the influence of liquor or at a gambling table. My associates were the best people of the country.

The narration in Brother Warman's article above referred to, of my youthful fighting proclivities, may lead some of the good readers to wonder if I am still fighting, and in conclusion of this article, I would like to mention one fight which my worthy brother failed to chronicle: The ring was pitched in the M. E. Church, South, at Colorado Springs, with two referees, viz., Revs. S. R. Belk and P. L. Stanton. I lost the fight, but the victory was the greatest of my life, for I realized that God for Christ's sake had pardoned my sins, and in the end I made a full and complete surrender to him, and from that time to the present I have been a member of the M. E. Church South.

Returning to Kentucky, I worked for the Louisville & Nashville as an engineer, resigning to accept a like position on the C. O. & S. W., where I pulled the throttle for about four years, finally losing my position through overlooking a train order. Again looking Westward, I found myself running out of Chicago on the "Last Chance" (you all know what that is), where I received a discharge for being a member of the B. of L. E., coupled with political views.

However, in my many changes my credentials from the officials have been good, and have not stood in the way of securing employment in any section of the country.

I am at present running out of Chihuahua, Mexico, on the Mexican Central, where I am well treated and well satisfied. I have never met, in all my experience, a better and more courteous class of officials, nor a more whole-souled lot of men than here (they won't fight, Brother Warman).

I still claim Caneyville, Ky., as my home, while my present address is Chihuahua Shops, where I should be pleased to hear from Brother Warman and other friends, or extend to them the right hand of fellowship, should their travels lead through Mexico.

JOHN M. JONES.

Chihuahua, Mex.

Peculiar Wear of Valves.

Editors:

It is my impression that the peculiar wear of slide valves described by Mr. Hungerford in your January number, is entirely due to the action of the exhaust. A very great force presses alternately against each side of the cavity of the valve at each exhaust; this has a tendency, and I firmly believe does, tilt the valve. I also feel sure that a large amount of pressure is wasted in this way. The blow or loss of pressure is not heard on account of the simultaneous action of the exhaust. I do not believe that there is now, or that there ever was, an engine using packing strips and springs that did not allow pressure to escape at every exhaust by the valve lifting from its seat with a rocking motion, and this rocking may in some measure be aided by the alternate overbalancing of the valve as described by Mr. Hemmenway in your March number. The frequent breaking of springs on the sides of the valves confirms me in the belief that the valve rocks as described. I think that the remedy may be found in the open top valve allowing the exhaust to strike a balance plate resting directly on the valve and not on strips. Experiments have recently been made on this idea with promising good results.

S. A. ALEXANDER.

York, Pa.

In the works of John Brown & Co., Sheffield, England, they have ten boilers developing over 10,000 H. P., in which the air for combustion is admitted entirely over the fire. They heat the air to between 200 and 300 degrees before admitting it into the furnace, which is done by heat that would otherwise be wasted. The effect of this arrangement is that the furnaces are totally smokeless. Those who have watched the operation of these boilers, say that it is the only case in Britain where large boilers burn soft coal, and yet produce no smoke.

There are certain men in Chicago and other Western cities, who make a regular business of stealing car brasses and selling them to junk dealers. A gang of this kind got into trouble recently by extending their operations and stealing about 1,000 feet of copper cable belonging to one of the electric railways. This was not so easily stored away as car brasses, and the thieves were captured with a complete outfit of implements for stealing car brasses in their possession.

Air=Brake Department.

CONDUCTED BY F. M. NELLIS.

An Automatic Pressure-Retaining Valve.

J. B. Starrett and E. F. Welsh, of Wilmerding, Pa., have been granted a patent for an automatic pressure-retaining valve, whose description is as follows:

Fig. 1 is a substantially central section through our improvement with portions in elevation. Fig. 2 is a section at right angles to Fig. 1 with parts in elevation and a portion broken away, and Fig. 3 is a detail in elevation.

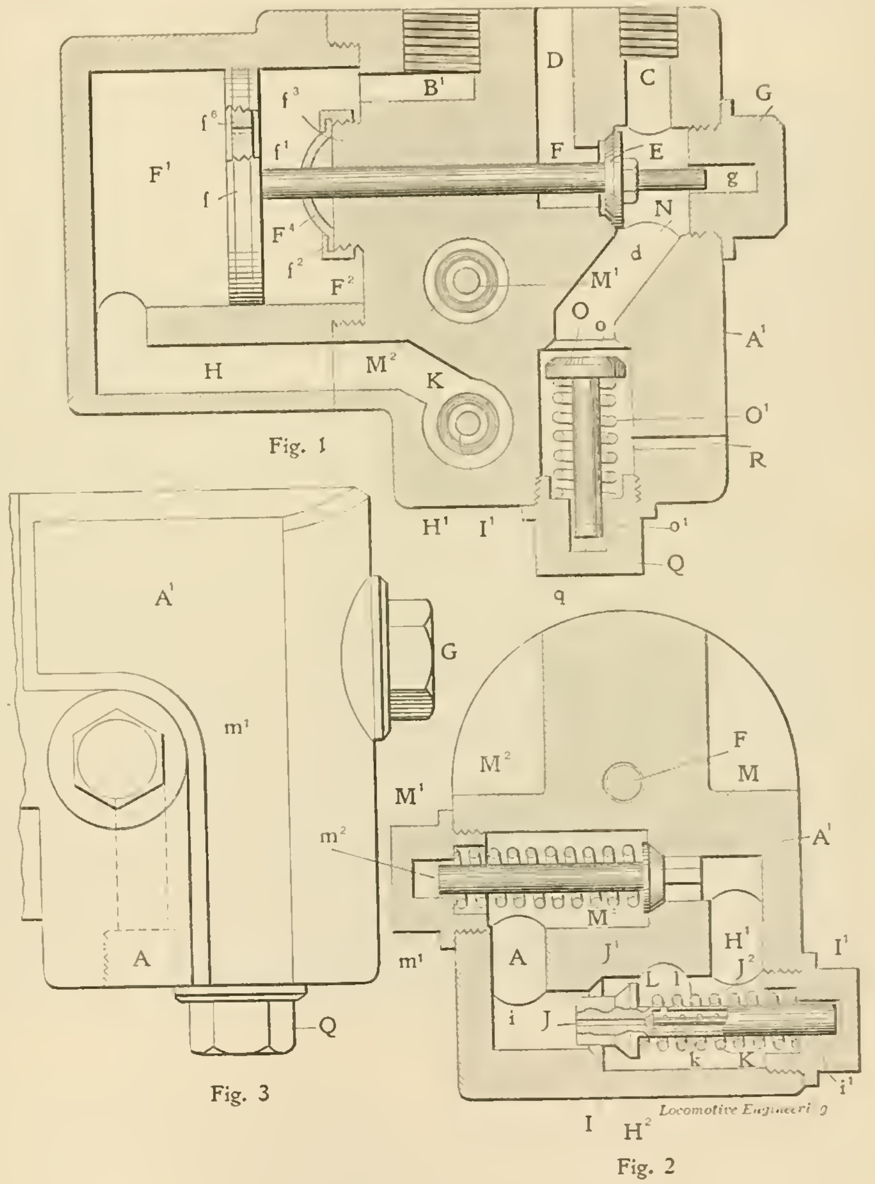
A designates a port which is adapted to be connected with the train-pipe of the air-brake system of any of the well-known forms.

B is the port designed for connection with the reservoir.

C is the port designed for connection with the triple-valve exhaust.

D is the exhaust to the atmosphere.

With the parts thus constructed and arranged, the operation is as follows: After the train is coupled, the engineer opens his brake-valve to feed position, which fills the train-line and the auxiliary reservoirs, and thus equalizes the pressure on each side of the piston valve *f*, the reservoir pressure coming in at the port *B* into the chamber F^4, and the train-line pressure coming in through the port *A* into the feed port *J*, and thence into the port *L* and through passageway *H* to the chamber *F'*, and through the equalizing port f^6 of the piston, which equalizes the pressure on both sides of the piston. If a reduction is made in the train-pipe at the port *A*, it causes the air in the chamber F^4 to force the piston outward, and when the pressure in the chamber *F'* has been reduced through the opening of the check valve *M*, by reason of such lowering of the train-pipe pressure, the pressure in the chamber F^4 overcoming that in the chamber *F'*, the piston is moved against the pressure in the chamber *F'*, and in the air in the ports *H* and H^2 finds its way through the ports M^1 and *A* to the train pipe. Thus the air in the chamber F^4 forces outward the piston, upon which is the valve *E*, until the latter is seated upon its seat *d*. This cuts off the port *C* from the exhaust port *D*, and throws the cylinder pressure into the inclined passage *N*, in which is seated the valve *O*, and this valve cuts off communication between port *N* and the exhaust *R*, the spring *O'* of this valve retaining the desired amount of air in the cylinder. To release the valve, air is let into the train pipe, which, entering at the port *A*, overcomes the tension of the spring acting on the valve *I*, and the air passes through the ports *H'* and *L* into the chamber *F'*, overcoming the pressure in the chamber *F'*. The piston is moved inward, and the valve *E* is moved from its seat and forced outward until it is stopped by the stop *G*. This opens communication between the port *C* and exhaust port *D*, and allows all the air in the cylinder to pass out at the exhaust port *D* to the atmosphere.



AUTOMATIC PRESSURE-RETAINING VALVE.

Modifications in detail may be resorted to without departing from the spirit of the invention or sacrificing any of its advantages.

Air Brake Items.

Send in correspondence as early in the month as possible.

Fourth Annual Convention of the Air-Brake Association, June 13th, Nashville, Tenn.

The new Westinghouse, 1897 catalog, is intended for distribution to purchasing agents and store room keepers, and not for general distribution.

Conger's Catechism on air brakes has reached its twelfth thousand. Sixteen pages have been added to it, making it more complete than ever.

There has just been constructed in the Big Four shops at Bellefontaine, O., a testing plant for air-brake appliances R. E. State has been placed in charge.

Inventors of two-pipe air-brake systems for recharging auxiliary reservoirs while brakes are applied, should carefully study Marsh's device, which appears elsewhere in this department.

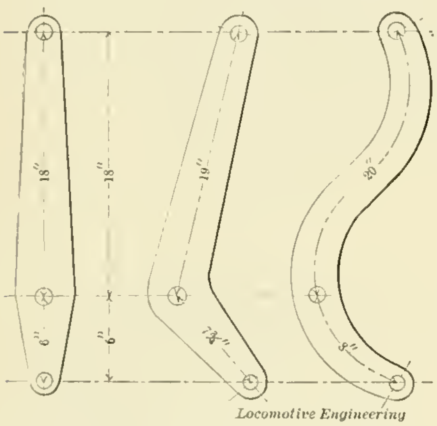
The phenomenal sale of the Air-Brake Men's "Progressive form of Questions and Answers," eclipses all former book sales. Write "Locomotive Engineering" for a copy. Price 25 cents.

Correspondents sending prints or cuts of devices for illustration, are requested to accompany same with description. There is no device, so simple or good, but what a better understanding may be conveyed by a concise lucid description.

Curved and Bent Levers.

When the arms of a lever are bent or curved, the distances between the connections must not be taken from lines characteristic of the shape of the lever, but must be taken on a line at right angles to the direction of the forces acting on the ends of the lever.

Although the three levers herewith illustrated seem to have different proportions, inasmuch that the dimensions marked on each are taken from lines characteristic of the shape of each lever, yet, if the three levers be used for brake-beam levers, and the pull rods be attached to the top ends, the brake beam to the middle connection and the connecting rod at the lower holes, the forces will be the same at all relative points of the three levers if the power at the top ends of the three levers is equal. In other words, if 1,500 pounds be applied at the top end of each of the three levers, the pressures at the middle and lower holes will be 6,000 pounds and 4,500 pounds, respectively, on all three levers.



No. 1 No. 2 No. 3

CURVED AND BENT LEVERS.

It will be noted that the proportion of a curved or bent lever is really higher than it at first appears to be, and the likelihood of sliding wheels is therefore greater with bent or curved levers than with straight ones, owing to the fact that dimensions are usually taken on characteristic lines.

The Air-Brake Association.

Five years ago there met in St. Louis a handful of air-brake men. In talking over matters peculiar to such a meeting, the organization of an association of air-brake men was proposed. A few months later, in Pittsburg, the Association of Railroad Air-Brake Men was formally organized. Each succeeding annual convention has improved upon its predecessor, and to-day the association stands with a brilliant record. By dint of hard work, during the four years the organization has been in existence, it has been brought to a prominent position, and is already recognized by railway officials and leading members of the larger mechanical associations as an important factor in modern railroading. Its members are specialists in a line which has much to do with railway economics, and they have already done much to fulfil the purpose of the organization—"To increase the efficiency of the air-brake service on American railways."

Not the least important and noticeable feature of this association's achievments, is the up-to-date air brake literature it has gotten out. Each year's proceedings contains new matter, and the varied experience of its numerous members of wide and everyday experience makes such information thoroughly reliable. The report of the proceedings is a book having many authors, and has recognized advantages over books written by individual authors.

Inasmuch that the work of the Air-Brake Association is in the interest of air-brake service on railways, it should receive the hearty support of railway managers. The achievements of the association revert to the railways, and should be fittingly recognized. Assistance and encouragement can be given by arranging to send air-brake representatives of the different roads to the convention. Should officials have any doubt as to the value and sincerity of these conventions, a perusal of the pages of the report of the proceedings will promptly dispel such misgivings.

The Fourth Annual Convention of the Air-Brake Association will be held in Nashville, Tenn., beginning April 13, 1897.

Automatic Slack Adjusters.

The automatic slack adjuster seems to have suddenly grown to be an important part of the air brake. There is no good reason why it should not be so considered, for a device which will successfully take up slack automatically, and maintain a uniform travel of all brake pistons, is a most valuable adjunct to the air-brake system. No matter how perfect may be the valves and other parts of the brake, it rapidly reduces in efficiency unless the travel of the piston, due to wear of brake shoes, be restricted.

Hand adjustment suffices for the time being only. It is not permanent. The piston travel will increase, and the efficiency of the brake proportionately decrease until opportunity for readjustment is had. In the meantime a wide discrepancy in the efficiency of brakes grows and exists. To maintain a uniform adjustment of piston travel by hand adjustment is practically impossible.

A pamphlet on the McKee slack adjuster, but more particularly on points of relationship between the air brake and slack adjusters in general, has recently been issued by the Q. & C. Co., of Chicago. The absence of extravagant claims, usually made by manufacturers for their wares, is particularly noticeable. Little reference to the article for sale is made in this modest pamphlet, whose aim seems to be to instruct rather than to sell, and which has set many air-brake men to thinking on points pertaining to foundation brake gear which have hitherto been deemed of trifling importance, or have been entirely overlooked.

It has been generally known for some time past that a brake piston adjusted to travel to a certain stroke when the car was standing still, would travel further than that stroke when the car was running; but it remained for the little pamphlet to tell us that the slack on all cars does not increase alike, and that the increase was governed by a ratio which depended upon the number of times the pressure on the brake shoes was greater than the cylinder pressure. A high-leveraged car would wear off brake shoes, and consequently increase piston travel, much more rapidly than would a low-leveraged car.

The automatic slack adjusters have our best wishes, and we are glad to see railways adopting them.

Marsh's Recharging Device.

The scheme of recharging the auxiliary reservoir while the brake remains set is an old one, and has been worked out in many different ways.

The method followed by nearly all has been to employ a second line of pipe. Others have accomplished it without the use of a second pipe, but no device has yet come under our observation that is so ingenious and simple as the one invented by Mr. Marsh, a description of which appears elsewhere in this department.

It is reported that Mr. Marsh once rode down the Sierra Nevada mountains on the brake beam of a freight car on which he had placed his device, in order that he might better observe its operation.

Orders have been received by the Q. & C. Co., of Chicago, for 400 McKee slack adjusters for use on freight cars, being built for the K. C., P. & G. Ry., by the Missouri Car & Foundry Company. An order for thirty-five adjusters for passenger service, has also been placed with the Q. & C. Co. by the D., L. & W. Ry.

CORRESPONDENCE.

C. & O. Test Plant at Covington.

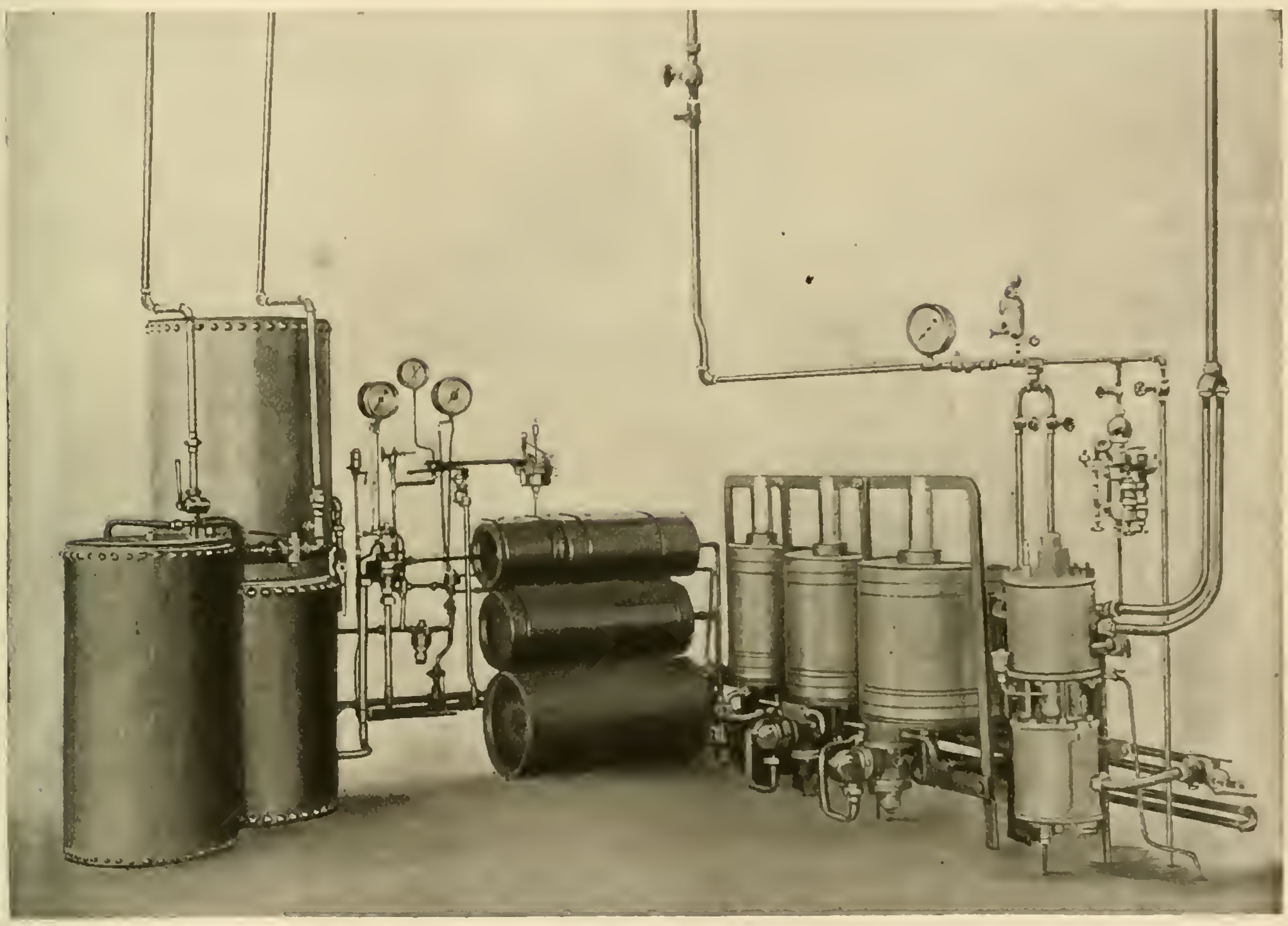
Editors:

The accompanying photograph illustrates our new air-brake testing plant in the C. & O. Ry. shops at Covington, Ky. All work is tested on this rack before entering service, and we are therefore relieved from putting on the finishing touches on the air-brake work in the roundhouse and yard on a hot engine.

Pump governors, plain triples, freight and passenger quick triples, and special quick-action triple valves for 12-inch and 14-inch cylinders are tested, and must pass inspection, before being placed in service. Eight-inch and 9½-inch pumps, E-6 and D-8 brake valves, old and new reducing valves, pressure-retaining valves, signal valves, gages and lubricators are each tested as shown in the photograph before entering service.

The large reservoirs at the left of the picture supply pressure for shop use, such as air hoists, paint burners, painting cars, white-washing, sand blowers, removing and replacing engine tire, for operating portable rivet forges, etc. There is also a connection for testing injectors, and we know just what condition the ram priming valves and seats are in.

P. P. HALLER,
A. B. Insp., C. & O. Ry.
Covington, Ky.



CHESAPEAKE & OHIO TEST PLANT AT COVINGTON.

Different Air-Brake Systems.

Editors:

Referring to Mr. Smith's communication on page 242 in March number, wherein he complains that railway companies are depriving themselves of probable improvement in air brakes by adopting any certain standard, I would say that it would seem that those who are opposed to adopting a standard for air brakes cannot be qualified to judge, or else they must have a preference for some other form of brake for personal reasons.

Surely railway companies and those who are looked to for the proper handling of air brakes on trains made up of cars belonging to a dozen different railroads, would not advocate having as many different systems of brakes on these cars. And yet, if the Master Car Builders' Association had not given their attention to this matter, that would be the condition of things to-day, as is evident by the number of different systems shown at the trials inaugurated by them in 1887 and 1888 on the C., B. & Q. road at Burlington.

I consider the adoption by them of a standard system of air brakes as a most valuable service rendered the railroads of this country. It has rendered possible the use of brakes on freight cars which could not be had with different and conflicting forms.

Mr. Smith says: "Is it good policy for railroads to adopt any particular plan, and force everything to conform to that style? Certainly that is a stumbling block in the way of inventive improvement. The writer of this recalls when one of the locomotive builders of this country wrote against link motion for locomotives. To-day all locomotives (nearly) have the link. Would it have been good policy to have adopted the valve motion of that day, and thereby stopped improvement therein?"

In the first part of the above quotation, Mr. Smith would ask the railroads of this country to change the air-brake equipment on their cars to accommodate one man's ideas, and in the last part condemns a policy which would adopt a valve motion for locomotives which one locomotive builder advocated.

I would say to inventors not to waste time and money in devising a way by which you can increase the number of air brake parts on cars. Six years ago, when the writer knew very much less about maintenance and handling of air brakes than he does to-day, he had a scheme for a two-pipe system, but soon learned that any scheme using two pipes and hose was not practical.

E. G. DESOE,
A. B. & S. H. Insp.

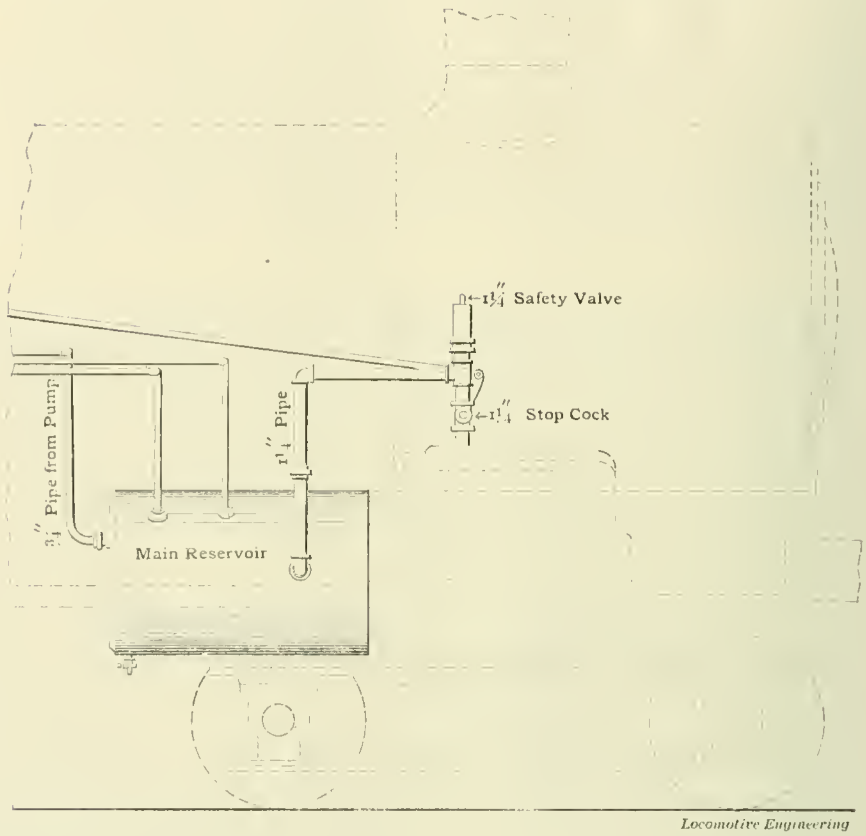
Springfield, Mass.

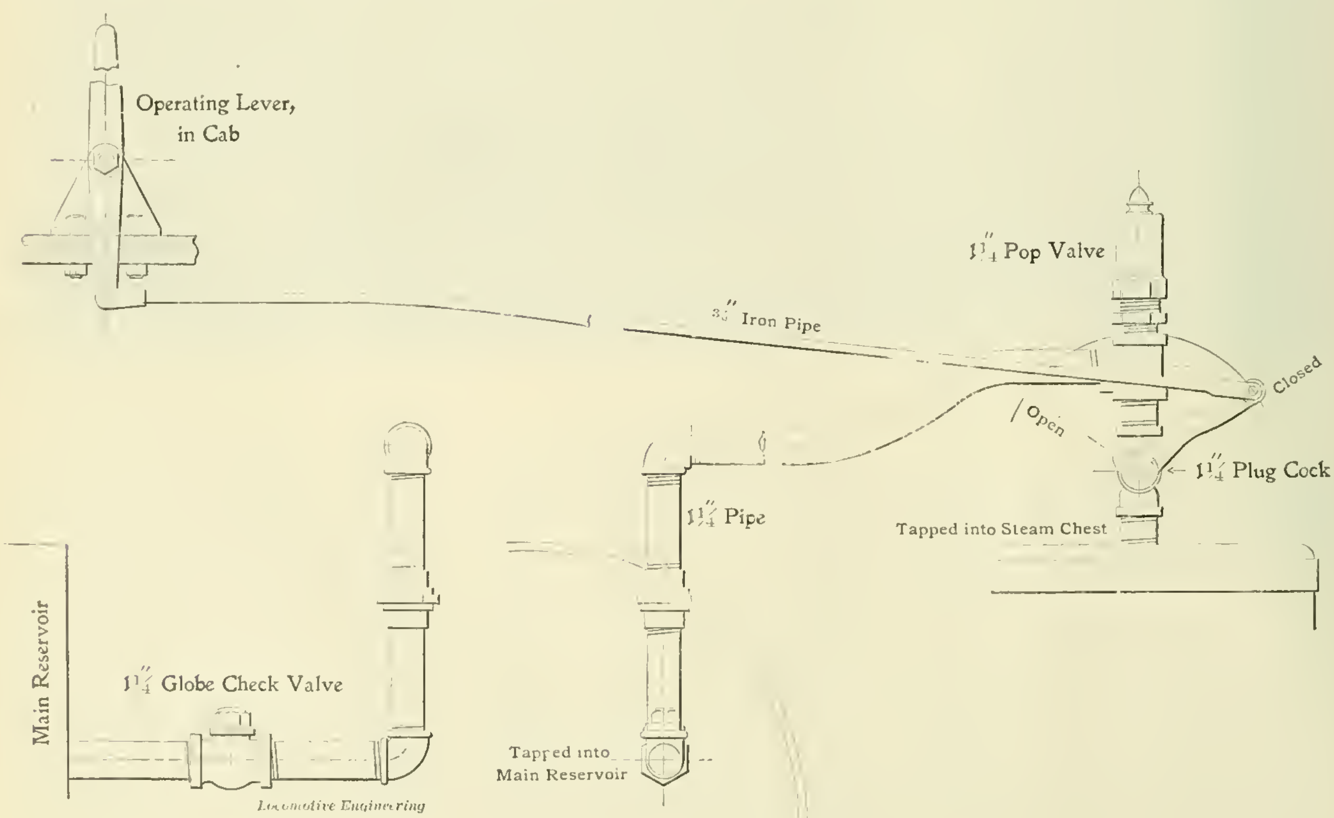
The Sweeney Air Compressor.

Editors:

As the Sweeney air-compressing device has been recently under discussion in your columns, and believing a drawing might perhaps enable readers to obtain a better understanding of its operation and utility, I send you prints of the device for illustration.

The "Sweeney," as it is commonly known, is simple in design, and has proven a valuable auxiliary compressor on this and neighboring systems in the Far West having heavy mountain grades. As shown by the cut, a 1¼-inch pipe is tapped into the top of the steam chest, and leads into the main reservoir. In the pipe is a stop-cock which is operated by a suitable rod from the engineer's cab. There is also a non-return check-valve in the pipe, a few inches from the reservoir. When the stop-cock is opened and the reverse lever is placed back of the center notch, both steam cylinders and pistons are converted into air compressors, which force air, drawn through the nozzles, into the main reservoir at a rapid rate. A safety valve prevents a too high and too rapid charge. Thomas Sweeney, a Southern Pacific engineer, is the inventor. The "Sweeney" has earned its well-deserved popularity by its ever-reliable assistance in supplying pressure, ofttimes furnishing the entire amount itself at critical times on our many car trains on long, heavy down grades. Should the air pump become





SWEENEY AIR COMPRESSOR.

disabled, or prove incompetent to supply a sufficient quantity of pressure for the train, the "Sweeney" is always ready, and will respond to call.

The better way to operate the "Sweeney," and the way we employ, is to place the engineer's brake valve on lap position, open the cylinder cocks until all moisture is expelled, open the plug cock in the device, and then place the reverse lever 8 or 10 inches back of the center notch. In about fifteen or twenty seconds the "Sweeney" will have compressed 120 or 130 pounds in the main reservoir. The plug cock should then be closed, and the lever placed in the forward motion, thus throwing the "Sweeney" out of use. The train can then be recharged in the usual manner, and the operation can be repeated as many times as it is necessary. Care should be taken to close the stop-cock after the main reservoir has been charged, otherwise steam, when used, will have free access to the air-brake system, with detrimental results.

The erroneous practice of some engineers, to place the brake-valve handle on full release position, open the stop-cock, and place the reverse lever in the extreme back notch, thus forcing air at an extraordinary high pressure and high temperature into the train line and auxiliary reservoirs, is not so effective as the method above described. It places unnecessary strain upon the hose, and the hot air, upon cooling, loses a certain percentage of its pressure.

The "Sweeney" can also be used on level divisions, should occasion require it. In such event, upon approaching a station where a stop is to be made, and after steam has been shut off, the brake-valve handle should be placed in full release position, cylinder cocks opened while the driving wheels make three or four revolutions, and then shut, plug-cock opened, and reverse lever placed a notch or so back of the center to pump up the train to maximum pressure. When this is done, the brake-valve handle should be moved to lap position, and the reverse lever dropped into the extreme back-motion notch to accumulate a good excess pressure with which to release and recharge brakes. A very leaky train-pipe might possibly prove an annoyance and hindrance to a successful performance of this latter operation.

H. W. Decker,
Gen. A. B. Insp., So. Pac. Ry.
Sacramento, Cal.

Marsh's Pressure-Retaining and Recharging Device.

Editors:

I inclose a blueprint of a device for retaining the pressure in the brake cylinder while the auxiliary reservoir is being recharged on down grades.

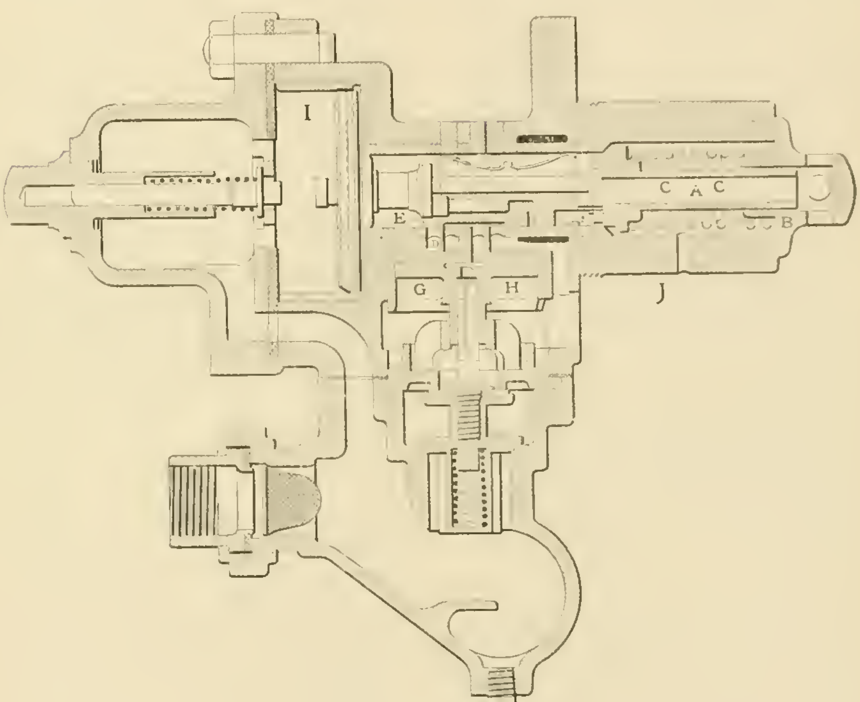
My invention relates to an improvement on the Westinghouse automatic air-brake triple valve, for the purpose of retaining the pressure in the brake cylinders while recharging the auxiliary reservoirs when descending steep grades, and at the same time admit of the immediate and entire release of the brakes, by the engineer, if desired.

Presuming the reader understands the connection of the train pipe to the triple valve, the passage of air through the same to the auxiliary reservoir, and the operation of the valve in conjunction with the brake cylinder, the accompanying drawing will suffice to disclose the construction, operation and merits of my device.

Referring to the drawing, I secure to the inner or reservoir end of the triple valve casing, a cap containing a stem marked *A*, which is forced against its seat on the end of the valve body by a spring marked *c c*.

In the seat of the slide-valve, and just back of the regular exhaust port, I make a supplementary exhaust port, marked *D*, and lengthen the slide valve enough to close it when the valves are in full release, as shown in the cut.

In the regular exhaust port, I place a pet cock for the purpose of closing the port.



Locomotive Engineering

Now, supposing this exhaust port is closed by the pet cock, and the pressure be applied in the train pipe. The first effect of this pressure is to compress spring *c c* and to force the piston and slide valve to the extreme right; but by reason of the exhaust port being closed by the pet cock, the air from the brake cylinder is not allowed to escape through said port as it ordinarily does, nor can it exhaust through the new port on account of that channel being closed by the slide valve while the parts are at the extreme right. The air, therefore, first passes through the groove *I* in the piston valve cylinder to the slide valve chest, and on into the auxiliary reservoir through the hole in the stem, which is forced from its seat through impingement with the piston and slide valve. As soon as the accumulating pressure in the auxiliary reservoir equals that in the train pipe, the spring *c c* will throw the slide valve and piston back. This backward movement of the parts brings the supplementary exhaust port into communication with the brake cylinder, allows the air to escape, and consequently releases the brakes. It will be seen that this is not done until the auxiliary reservoir pressure has been restored to an equilibrium with the train pipe pressure.

After admitting the air to the train pipe, should the engineer wish to release the brakes before an equilibrium of pressure in the train pipe and auxiliary reservoirs has been established, he can accomplish it by replacing the engineer's brake-valve lever on lap position for a few seconds, thereby cutting off the supply of pressure from the main drum, which will allow that in the train pipe and auxiliary reservoirs to equalize immediately, and therefore release the brakes.

My device has a tendency to equalize the holding power of different cars, and thereby avoid the heating of wheels. This is accomplished by the brake that is doing all the holding having a short travel of its piston and absolutely tight packing, and will, consequently, charge first and relieve the friction on its wheels, while the car with a long piston travel will be the last to recharge. With a little practice, the engineer can reapply the brakes again, and avoid the entire release of the tardy recharging cars.

While running on the level, the pet cocks in the regular exhaust ports are kept open, which allows the brakes to operate as usual.

G. W. Marsh,
Southern Pacific Ry.

Oakland, Cal.

Jake Baker Joins the Air-Brake Men's Association Club—First Degree.

Master Yeditor:

I vill dell you all aboudt vat dook blace mit me last veek, you know. Oder if you dond no den I dells you. Katrina, dats my vife, say to me "Jake, if you vas to be blowted up mit a throly gars or runedt over mit a stheam boadt, I vas lefdt mit no monie. Vy you dondt pe inshuredt mit your lifes."

Vell I dinks aboudt dot som quite a liddle. It vas my dudy dot my vife dondt go by de boor house, uf I can helep id, undt I tinks id vas pesdt to be inshuredt. I speagk to my frendt Lum aboudt et undt he say, "Of gourse you vant to hefe inshurance by your life. You vill jine der Are Bragke Essosiashun Glub. Dot vas en ordter dot vill coste you only tree toller fer de yere, undt uf you vas deadt or been kilt your femily pudts on sthyle mit der ten tousendt tollers in ghreenbecks. I gids you a bedishun righd avay, und ve pudts you trou ligke some creased lidtenin."

So Lum, he gids me a bedishun of dei memberships vat vant ter jine der glubs, undt I sindt him der paper, ven I also gift him my lest veeks vages, es en inshurence uf my pest uf faidth to apbear et der apbointedt dime to receif der decrese, broviding I vould pe eggsepted.

Pooddy quick I reseiffedt er nodise uf my bedishun hedt peen bellodted for undt nodt regectedt, undt to magke myselef bresent at der Demble Door der ferst Frytay after full moone uf der ferst mondth uf der yere, et 7.23 B. M. sharpe.

Et der apbointedt dime I vas on der decks, undt der blay vent on. Efter I vas hootvinckt and von of my bant legks cut off by der nee, mit a toe lines aroundt my sthumick so I vouldtendt run avay, I vas blased pehindt der dore undt gifet som rabps. Ven a man vats voise soundt ligke he vas peen teadt more as dwendy yere, saidt, "Ho I vas undt vy I vas lofen aroundt hear?" Now dis vas a funny dings to esk me, ven I vas nodifide to apbear at dis sthaded dime, budt I ensered him ven I sphoke, dot my name vas Bagker, undt I vas coome to jine der glub.

I vas den eskt uf I vas a "nine boint men." I saidt I vas, budt I hadt fergodt dose tigkets. I tell him my vord vas goodt ven ackoompny mit my monie. Dot dey hadt alreadty godt dis pefore dey reseife der vord. He also eskt me uf I hedt som more resins vy I eggspegtedt to gedt som more uf dose impordendt brivileges. I sadt dot I hadt; dot I vas so oldt I coodt vodte of unlawful hebits und pooddy vell regkomendted.

I vas den eskt uf dis vas som eets uf my owne fre vill, undt I saidt, "You bedt." Den he saidt, "Dis tis vell. Ledt him endter dis sanktum sanktorum, undt pe reseifed in der regkeler forme, as all dose who heve trevelt dis race corse pefore." Budt pefore I vould reseife any more uf dose segrets I moost toogk ubon myselef an oplegashun undt eskt uf I vas villingk. I saidt, "Vy sure."

I vas den condugtedt to der mitdle uf der roome undt toldt to neal pehindt der main drum. Mit er tripble velve in my righdt hend und er redaining velve in der lfedt undt toldt to repeadt efter my name in ful, " I Yacob Bagker uf my one vill undt agordt do herepy schwear and bromise, I vill alvays refeal und nefer gonseal any uf dose segrets vich I hefe nodt reseifet, nefer vill reseife or may nodt hearefter reseife. I bromise also dot I vould alvays pay my duse undt subort der gonstidution undt der pylaws so long es I vas gombeledt to. I also bromise I vill helb undt gomfert a vorthy brodther ven in neadt by delling him he vas nodt der only beble on der peach; dot I vas som punkinz myselef. Also to imbress on his mindt der neseserty uf henging der hose up, turning der redaning velve down, see der bragke vas cut in undt der hend bragke vas toogkt of pefore sthartin oudt, unat den porrow a hendful uf fine kut undt pess on.

I also bromise to upholdt der tignity uf der glub by loogkin vise ven som pody eskt som gwestins, undt say, "dot vas do teap fer dere gomprihenshuns, undt to gonseal der missteries uf der Are Bragke in efery bossible vay." Do all dis undt more es a tousandt onder bromises dit I oplicate myselef, pinding myselef uf no lesser benalty dan dose uf hefing my nose puledt oudt py der root, bodth my eyes bleckedt undt pungdt up, undt my pest Suntay gote ripedt up der beck uf I vould efer fiolete dis my oplicashuns.

Efter dis I vas pudt true som more high kigkin, und py undt py I vas gombletly nocket oudt like der Fitzsimmons man slugdt Chim Korbett.

Undt now, Master Yeditor, I vas so lame py my beck frum to much eggsess, undt py peing ofer-charched, dot idt vill pe nesesary fere me to lay of py my thrain to gidt prased up. Der dochter saidt I vould pe aple to reseife my negxt decrese in aboudt two veeks, uf I hef lugk. Undil den I vil say,

Yours slidely disfigkerd,
Jacob Baker,

Elmira, N. Y.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(54) F. S., Little Falls, N. J., writes:

Give rule for figuring crooked or bent levers. A.—See sketches of levers and description elsewhere in this department.

(55) J. N. Palmerston, Ont., asks:

In finding the total brake-beam leverage, why is it that with the Hodge system we are to multiply by 2, and by 4 for the Stevens system? A.—See reply to "E. G." in question No. 50 in March number.

(56) A. R. L., Albany, N. Y., writes:

Are the new Westinghouse "F" catalogs mentioned in March number for general distribution? If so, how will I proceed to obtain one? A.—No, they are only intended for purchasing agents and others who have to order material from the manufacturer for the railroad.

(57) V. I. R., Oskaloosa, Ia., writes:

1. Where does equalizing port *g* run to in D-8 valve? It only shows a small black spot on diagram. A.—Its terminals are the rotary valve seat and equalizing chamber *D*. 2. Where is port *d* found in D-8 valve? A.—There is no port *d* in either the D-8 or E-6 brake valve.

(58) C. H. G., Nevada, Mo., writes:

With a train of three quick-action Westinghouse air brakes, everything in good order, will the brakes go on in quick action to place the engineer's brake valve handle in service-application position and leave it there till all air is drawn from train pipe, or make one 20-pound application through the service-application port and place the handle on lap? The style of engine valve as shown in book of 1890. A.—No.

(59) J. M. D., Arkansas City, Ark., asks:

Why would not driver brakes do better on top of the drivers, especially on low-wheel engines that are continually tearing them off when getting off the track. A.—It would be almost impossible to attach a brake in that manner on the modern locomotive, and more particularly so on low-wheeled engines. The scheme has been many times advanced, but is not a feasible one.

(60) C. W. H., Jamaica Plain, Mass., asks:

With an emergency application of a plain triple, do the brakes go on any sooner than in a service application? A.—Yes, because the triple piston travels its full stroke, and a more direct and easy passage for pressure from the auxiliary to the cylinder is had than when a service application is made when the auxiliary pressure passes to cylinder through the graduating port. The same cylinder pressures are obtained in both cases.

(61) B. W. R., Marshalltown, Ia., asks:

What is the object of port *p* in rotary valve of D-5 or E-6, brake valve being made longer than in a D-8? A.—In a service application groove or port *p* connects port *e* and groove or port *h*, and discharges pressure from chamber *D* to the atmosphere. In emergency application port *e*, groove *p*, groove *h* and port *k* exhausts pressure from chamber *D* and permits black pointer or gage to drop to zero. The latter function requires the additional length of port or groove *p*.

(62) C. W. H., Jamaica Plain, Mass., asks:

Is there any difference in size of feed ports, in the plain and quick-action triples? A.—That in the plain triple is larger, as shorter trains were hauled when that valve was invented. The quick-action triple has made it possible to operate brakes on much longer trains, and in order that all brakes may be released before much of the replenished train-pipe pressure has fed into head auxiliaries, the grooves in the quick-action triples have been made smaller.

(63) C. W. H., Jamaica Plain, Mass., asks:

What is the graduating stem and spring of the plain triple for? A.—At one stage in the evolution of the triple valve these parts performed an important part in the graduation of the triple, but since the graduating valve was incorporated in the structure, the graduating spring and stem have merely acted as safeguards to prevent the triple piston going full stroke when moderately harsh train pipe reductions were made, and parts were not cleaned and properly lubricated.

(64) D. M. W., Southbridge, Mass., asks:

What is the resistance of springs 64 and 68 in feed valve attachment, D-5 brake valve, having 90 pounds in main reservoir and 70 pounds in the train line? A.—The resistance of spring 64 is insignificant. Feed valve piston 74 is 2¼ inches in diameter, and therefore contains nearly 4 square inches of surface. At 70 pounds train-pipe pressure there is a downward force of 280 pounds acting on the piston. To balance this downward force, the spring 68 must have a resistance of 280 pounds.

(65) J. N., Palmerston, Ont., writes:

If, when running down grade with pressure-retaining valves set at 15 pounds, I make a service application of the brakes, release and recharge auxiliary reservoirs to 70 pounds, can I get the emergency action of quick-action triple with 15 pounds in brake cylinder? A.—Yes, but the percentage of train-pipe pressure going to the cylinder will be less, of course, than if the brake cylinder were empty and the train-line pressure was at its maximum when the emergency application was made. The ultimate cylinder pressure will be little if any higher.

(66) C. A. R., Hempstead, L. I., writes:

If the equalizing reservoir on an engine should be knocked off, and the pipe which leads to it plugged up so as to stop leak and obtain pressure, the small volume of air in the pipe would soon be exhausted when an application was made, and allow piston 17 to rise and stay up. This would give a full service application, or, if the train line were short, would perhaps result in an emergency application through the train-line exhaust. Would it do any good to plug the train-line exhaust, and why? A.—See answer to "J. J." in question No. 42 in March number.

(67) S. H. D., Missoula, Mont., writes:

1. What is the capacity of the best Westinghouse air-brake pump in cubic feet of free air pumped per minute? A.—About 33 cubic feet at 110 strokes per minute is a conservative estimate of the capacity of the 9½-inch pump. 2. Does steam follow piston of air pump entire stroke, or is it cut off at a period early enough to allow for a small amount of expansion? A.—The greater part of the work being done at the ending of the stroke, renders it impossible to use steam expansively in the air pump. The cut-off is practically simultaneous with the reversal of the stroke.

(68) V. I. R., Oskaloosa, Ia., writes:

I don't understand port *b* of D-8 valve. On one instruction book card with movable handle, *b* is shown on the rotary valve or handle, while on the other card it marks the supply port in the rotary valve seat. Please explain. A.—You have been misled by the two cards in question. The card marked "Plan of Engineer's Brake, etc.," illustrates the real valve, and the ports thereon numbered and named are correct. The card marked "Diagram illustrative of the functions, etc.," is merely explanatory, and is not a real valve. The ports are conveniently named for descriptive purposes only.

(69) B. W. R., Marshalltown, Ia., writes:

What is the best method of fitting reversing bushings 22 8-inch Westinghouse pump? All bushings we have fit too loose and leak around the taper fit badly. A.—Unless specified in the order that a larger reversing piston bush is desired, the repair part sent is of the standard dimensions. The tapered surface is depended upon to make the fit. When the cavity into which bush fits has become worn, larger bushings should be ordered. The reversing valve bushing supplied for repairs is made about 1-32 inch larger than standard because the fit is a straight one.

(70) V. I. R., Oskaloosa, Ia., writes:

Is steam supposed to enter on the under side of reversing piston 23 of 8-inch Westinghouse pump? A.—Not live steam. Exhaust steam, however, has free access through the lower side ports of the bushing, and supplies a cushion for the piston in its descent. The upper side ports prevent a too rapid escape of exhaust steam from the top of the piston, and thereby cushion the piston on its up stroke. 2. What is the small hole for on the opposite side of the supply ports in bush 22, as shown in the cut? A.—To drain condensation from top of reversing piston and carry it to the stem below, where it serves as a lubricant and packing.

(71) C. W. H., Jamaica Plain, Mass., writes:

1. Explain why the release valve of tender brake is tapped into brake cylinder, while with quick-action triple it is tapped into auxiliary reservoir. A.—It was the early practice of the manufacturer to provide a means for "bleeding off" a "stuck brake" by placing the release valve in the head of the cylinder. Later it was found better to place the cock in the auxiliary reservoir and cause the triple to move to release stuck brakes. 2. Were the old passenger plain triples release valves tapped into the cylinders? A.—Yes, but as the auxiliary reservoir was later on seen to be the better place, the plug in the reservoir and the cock in the cylinder head were exchanged.

(72) B. W. R., Marshalltown, Ia., writes:

In making release with D-5 or E-6 valve, the air continues to blow out of exhaust fitting 51 if handle is thrown back in release position. But by making a movement to lap and back again it will cease. What is the reason the valve acts so? A.—The heavy releasing pressure coming from the main reservoir increases the train-pipe pressure under piston 47 higher and more rapidly than ports *e* and *g* can increase the pressure in chamber *D*. Piston 47 rises, and the recharging pressure escapes at train-pipe exhaust. By bringing valve handle to lap, the recharging pressure from main reservoir is cut off. The pressure in chamber *D* is held. The pressure in train pipe will continue to escape until it is slightly lower than that in chamber *D*, and then piston 47 will seat.

The engineers and firemen of the Cleveland, Lorain & Wheeling Railway, on the division between Uhrichville and Kirkwood, have formed an educational club, for the purpose of assisting each other in the education necessary to make a good engineer and fireman. We wish the club abundant success, and consider it a move in the right direction. It is a pity that more educational clubs of this sort are not in existence.

A circular issued by general superintendent Wilbur, of the Lehigh Valley, says: "Mr. John I. Kinsey is appointed superintendent of machinery, and will have general supervision of the stationary engines and machinery connected with the Perth Amboy coal docks, South Plainfield storage ground, Newark draw and coal trestle, Morris Canal, and the freight houses at Jersey City terminal. The superintendent of machinery will report to the superintendent of motive power."

LOCOMOTIVE ENGINEERING
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Persecutions Under Patent Laws.

A change in the patent laws, proposed by a bill which was before last Congress, requires patentees to be more diligent than they sometimes have been, in asserting their rights against infringements and against parties using patented devices without authority. The bill would limit the period of accounting to six years before the filing of the bill of complaint. A change of this sort ought to be welcomed by the users of machinery, and more especially by railroad companies, for the latter seem to have been the greatest sufferers from dishonest holders of patents. There has been a practice, among certain patentees and purchasers of patented devices, to permit railroad companies and others to use their patents without protest until the life of the same was nearly expired, and then proceed to prosecute them for damages for use of devices during the whole life of the patent. In many cases, users of patented articles, who were not aware that they had been patented, were encouraged to manufacture and use them, so that damages might be collected afterwards. It was well known that had complaint been made early in the life of the patent, the use of the infringing article would have been stopped.

Devices have often been invented simultaneously by two persons, or by more than one person, and it has occasionally happened that the latest inventor has been the patentee, yet those who invented the article first were eventually made to pay for the right to use their own device. The practice was common at one time, and is by no means ended yet, of rogues applying for and obtaining patents on articles invented by other persons. Those pirates would visit shops and factories and take notes of improved devices made by ingenious workmen, and then swear that they were the inventors and obtain patents under their false representations. These men generally follow the policy of permitting the parties whose devices they have stolen to go on using them until the patent has nearly expired, and then institute suits for damages. It is generally cheaper to make a compromise under circumstances of this kind than to attempt defense, and so men and companies have allowed themselves quietly to be robbed, rather than go to the greater expense of fighting the robbers.

Perhaps the most celebrated case of robbery of this kind happened in what was known as the Tanner Brake Suits. In 1846, Batchelder & Thompson, of Lowell, Mass., invented a car brake, to be operated by the bumpers. It was a wretched device and never brought into use, but they applied for a patent in 1847. Through various circumstances, their application was kept pending in the patent office until 1852. In the meantime, the Hodge and the Stevens brakes had both been invented and patented—the one in 1840, and the other in 1851. In 1847, Willard J. Nicholls, of Hartford, Conn., invented what was afterwards known as the Tanner brake. He put it into use, but never applied for a patent.

In 1851 Hendrick Tanner, of Buffalo, who was engaged in selling a brake, in the course of his travels, came across the Nicholls brake, and he adopted it. As there was no patent on it, he went to Washington and tried to find out something about it, and there found pending the application of Batchelder & Thompson for their brake. He bought the interest in this brake, cancelled the models, specifications and drawings and got a new set of papers instituted to cover the Nicholls brake, so that when the patent for the Batchelder & Thompson bumper brake, applied for in 1847, was granted, it covered the Nicholls brake, which had not been patented until that time, 1852.

The following year, Tanner began a suit against the Erie road for infringing his patent, by using the Hodge and Stevens brake. He obtained damages from the Erie and also from the Hudson River road for infringement of a brake that really had not been patented until years after the Hodge and Stevens brakes were in use. Two years later, Thomas Sayles, having become owner of the Tanner patent, began suing railroad companies right and left for infringement. There was scarcely a railroad in the country that was not compelled to pay damages for infringing the Tanner brake; many thousands of dollars were paid in this way, and it was estimated that had all paid which were found liable for damages, the sum would have aggregated ninety millions of dollars.

The holders of the patent seemed to pursue their course of robbery until 1878, when the Supreme Court decided against the Tanner brake on account of non-infringement. This released absolutely, not only the defendants in that suit, but all others who had used the Stevens brake, comprising a large proportion of the roads, especially in the West. The opinion of the court indicated pretty clearly that the Hodge brake, when its turn came, would also be held "non-infringement," and that the patent itself would be held invalid on account of change made in application to the patent office; but as neither of these points was decided, it left Sayles at liberty to continue litigation. He had already, in 1877, brought some two hundred new suits, thirty-three of which were against members of the railroad association, thirty in equity and three at law. In the equity suits, it was objected by defendants that the patent having expired there could be no jurisdiction, and consequently the court had no jurisdiction. The question came before the Supreme Court in a suit brought against Lake Shore & Michigan Southern, which was decided in January, 1879, to the effect that suit for infringement, as a rule, cannot be maintained in equity after expiration of the patent.

After obtaining a decree against the Chicago & Northwestern Railway, Sayles offered to settle with all the railroads for fifteen millions of dollars and passes. He gradually reduced his demands to three millions, and after that decree had been reversed by the Supreme Court, he came down to $350,000. A settlement was subsequently made by the Western Railroad Association for $500, and similar settlement was made by the Eastern Railroad Association. This wound up the case, but several millions of dollars had been collected from railroad companies in the meantime on worthless patents. The persecutions carried on under this patent were the means of bringing into existence the railroad associations, which have done so much to rid railroad companies from impositions of this character.

Favors More Uniformity in Rolling Stock

At the approaching conventions of the Master Car Builders' and Master Mechanics' Associations, both organizations will have under consideration reports of committees appointed to propose the means for reducing the diversity in the parts and proportions of railroad rolling stock and of recommending means to secure greater uniformity in designs. It is earnestly to be hoped that the labors of these committees may be fruitful of progress in a direction where the associations have shown their greatest usefulness.

During the whole existence of the two leading railroad mechanical associations in this country, there has been a constant endeavor towards making railway rolling stock uniform. The individual tastes run towards diversity, and the intentions of the associations have worked towards suppressing individual predilections and favoring designs that would make the parts interchangeable. The Master Car Builders' Association has been fairly successful in this line of progress, and the efforts of the Master Mechanics' Association must have had good influence, but it is difficult to see this influence on existing designs of locomotives.

The history of locomotive development has been that after a time locomotive engineers learned by a tentative process what proportions of heating surface, grate area and cylinder volume provided the most economical engine, and writers on locomotive engineering formulated the data, and it became accepted as the principle of sound locomotive designing. For the last 25 years, there has been a tendency among designers, more especially in this country, to ignore the rules followed by early engineers, and the diversity appears to be growing worse confounded every year. Anything which increases the diversity of railroad rolling stock is a source of extra expense to railroad companies, because this diversity must be paid for in more costly construction and more expensive repairs.

There is no good reason why railroad companies should not agree to have locomotives and cars built on the same principle that the Westinghouse air brake is manufactured on. Nothing prevents this except the individual preferences of railroad officers. These preferences are nearly all founded on prejudices, defective knowledge and the desire to be odd.

The popular argument in favor of diversity of rolling stock has been that the physical conditions of different railroads require different forms of locomotives and cars. Also that the forms of locomotives had to be modified by the character of the fuel available in localities widely separated from each other. Of course, it is correct to say, that railroads in a hilly country require heavier locomotives than those running through plains and prairies, but the difference, except in diameter of driving wheels, does not need to vary materially. If a cordial effort were made to try and find a few forms of locomotives that would be adapted to the operation of all kinds of railroads, we believe that the variety of types could be reduced to a very small number, and that the proportions of the parts could be made interchangeable in nearly every case. In the case of cars, the difficulty of making uniformity, owing to geographical and other differences of the railroads, would be much less perplexing than it is in regard to locomotives.

If all the railroad companies would agree upon standard proportions of the various types of locomotives, so that builders could work constantly to standard patterns, the purchasers would save on an average $1,000 an engine, first cost All parts for repairs could be kept ready in stock, they could be purchased at much lower cost than at present, as special machinery would be designed for their production, and locomotives would be much shorter time from service undergoing repairs. This would mean that the work of transportation could be done by fewer locomotives; the same arguments apply in the advantage of standardizing cars.

In a very carefully prepared article on "The Present and Future of American Railways," contributed by Thomas F. Woodlock to the "Engineering Magazine," the statement is made, and evidently proved, that in future the profits to investors in railroad property must be drawn from savings in the cost of present operating. Rates for transportation of passengers and freight have fallen very close to actual cost, so that they are not likely to go lower, but they cannot be raised. There is no going back in the direction of better prices for work done by railroad companies. Under the circumstances, the most successful railroad man will be the manager who devotes the greatest attention to saving on small details. The complete standardizing of rolling stock would effect savings which could provide dividends to roads that are now chronically insolvent. That is the situation to be faced, but recent designers of railroad rolling stock do not seem to be working in the style that will lead towards uniformity; the trend of their work is in quite the opposite direction.

The possibilities of further reducing the cost of building and repairing rolling stock by the employment of perfected tools and highly organized methods, are about exhausted. The only thing therefore that now remains in this department of railroad expenditures is the employing of rolling stock that by interchangeability of parts will cost less for repairs, and cause reduced delay while repairs are going on.

Rolled Finish on Cylindrical Surfaces.

During one of our recent rambles in the South in looking up points wherewith to satisfy our yearning to keep in touch with the best methods of turning out work, we found that in the Huntington shops they were using the steel roller on almost all cylindrical wearing surfaces. The beginning of this practice in these shops was made on car axle journals, similar to what was already being done in a few other shops, and the results were so satisfactory that driving-axle journals are now finished with the roller; continuing in this line of experiment, it was seen that piston rods could be made smoother and truer with the roller than with the tool, and the roller finish is now the order for pistons, while a device is being experimented with to hold valve stems rigidly enough to withstand the pressure, when they too will get the same treatment for finish.

It is shown that the surface left from the rolling process is very dense and leaves a skin quite appreciably closer and tougher than when raw from the tool, and therefore gives a longer life between turnings. No files are allowed to be used on turned work, either for fit or finish, the roller leaving the work absolutely straight and round, or as near that state of perfection as the condition of the machine will permit. In any event, a finish with the roller has been found to be superior to that of the tool in all respects, for the reason that there is no cutting edge to be sacrificed, and no consequent taper due to wear of the tool. Our publication of the roller as we found it in use in a few other shops, has been the means of its adoption in many places where it was unknown before, and so with other shop kinks that we are constantly in quest of for dissemination among our readers.

Car Ventilation.

Any person who enters, in the small hours of the morning, a crowded passenger car which has been running all night, with little opening of doors, will be convinced by his sense of smell that the ventilation of passenger cars is far from perfect. It appears to us that the comfortable heating of cars which has resulted from the general use of steam or hot water has rendered imperfect ventilation much more conspicuous than it was in cold cars, and to this may be due the agitation against badly ventilated cars, which has lately come round in shorter cycles than it formerly did. The worst ventilated car is seldom in worse sanitary condition than badly ventilated bed-rooms; but, of course, the renter of a bed-room has not got the shortcomings of a railroad corporation to complain about, and discomforts that cause no complaint from householders or their tenants arouse fierce wrath when a railroad company is the delinquent.

The volume of fresh air admitted per hour into the ordinary car is fairly well known, and scientific investigators have shown how far short it comes to satisfactory conditions; yet very little improvement has been effected since railroads began to carry passengers. In a lecture on "The Ventilation of Passenger Cars on Railroads," delivered by Dr. Dudley, of Altoona, Pa., at the Franklin Institute, Philadelphia, the speaker stated that experiments which he had made, indicated that the inside of a passenger car receives from one-eighth to one-tenth of the change of air which it ought to receive.

An ordinary passenger car has about 4,000 cubic feet of space and provides accommodation for 60 passengers. There is mixed with the air everywhere a small volume of carbonic acid gas which averages about 4 cubic feet in 10,000 cubic feet. Chemists say that this admixture of carbonic acid cannot safely be increased more than 2 cubic feet above the normal without endangering the health of those breathing it. It is known that every adult person, by breathing, converts about six-tenths of a cubic foot of the breathing medium into carbonic acid each hour. When the work performed in this line by sixty persons is figured, it shows that a car of 4,000 cubic feet of volume gets badly diluted with foul air. Dr. Dudley says that, to keep the air within the health limit, 180,000 cubic feet of fresh air would need to be admitted every hour, which would be equivalent to changing the entire volume of air forty-five times per hour. This would keep the people in the middle of a small tempest all the time, and heating of the car to a comfortable warmth would be impracticable.

That is the difficulty which cannot be overcome. Perfect ventilation and comfortable heating cannot go together in the small volume of a railroad car, with so many persons vitiating the air. There are few halls or theatres that are perfectly ventilated, although their height makes the problem of air changing and heating much simpler than it is in a railroad car. In experiments made on the Pennsylvania Railroad, it was found that 90,000 cubic feet of air was about the limit of air that could be admitted to the car each hour, under control, but it was not possible to increase the heat more than 40 or 50 degrees. With a train of twelve cars, it was calculated that from 3 to 4 per cent. of the whole heating capacity of locomotive boiler would be needed to heat the cars comfortably.

The teaching of the experiments referred to, and of many investigations formerly made by other railroad companies, is that a compromise must be made between good ventilation and satisfactory heating. During cold weather, passengers must be contented with from 20,000 to 30,000 cubic feet of fresh air, while in warmer weather the supply may be about half the theoretical requirement.

If there were no question involved beyond the admitting of the air required, it would be an easy thing to do; but in car ventilation there are conflicting conditions, similar to those of preserving the unhampered flow of the fuel gases from locomotive tubes while preventing the emission of sparks. A perfect ventilating system must admit pure air alone. It must keep out cinders and smoke and dust. When passing through tunnels, it must close out the foul gases that linger in such places, and it should cool the air in summer and warm it in winter. Various inventors have offered to supply apparatus that fulfill all these conditions; but somehow, when subjected to practice, they were found wanting, and the intellect of the brakeman had to do the regulating, with the usual result.

Abuse of Shop Kinks.

Shop kinks are capable of abuse as well as use. They can be made to give a return for their cost that will put the books in "unstable equilibrium" with the same facility and ease as the most careless management. They can be made to drag on shop economy until every dollar they should save, but don't, stands as a reproach to their presence as factors in a failing business.

Intelligence must be used in guiding these labor-saving appliances, or they fail of their purpose. Time spent in long waits to get the use of some tool, when a few of those wasted minutes would do the job in hand without it, represents one of the abuses of kinks, because the tool stands responsible for the loss of time in waiting when the wait was unnecessary.

It would not be regarded good shop practice, nor a sensible procedure, for a man to employ the traveling crane to carry a sandbox cover from one end of the shop to the other, even if that important tool was not otherwise engaged at the time, simply because the article in question could be transported by hand in less time. Kinks used rightly are money-makers, but when used as cloaks to hide the designs of time-servers, they rapidly assume the role of money-losers.

Supervision of Coal Supply.

The general manager of the Wabash Railroad has instituted an arrangement, which we are persuaded will result in considerable saving of fuel to the company. The position of road foreman of engines has been abolished, and that of inspector of fuel and locomotives has been created. On the face of it, this seems to be little more than a change of name for an important position, but we understand that the holder of the new position has control, not only of the way fuel is used, but the quality of fuel supplied. One of the great sources of waste of fuel in locomotives has been the great variety of coal supplied to the different coaling stations. Those who purchase the coal, as a rule, seem to pay no attention whatever to securing uniformity of quality. One supply of coal will be first-class in every particular, and the next will be so bad that few engines can make steam freely when using it. This diversity in supply requires that the draft applicances of the engines should be adjusted, so that they can burn the worst quality of coal freely. The consequence is that the exhaust is too sharp for the use of good coal, and a great deal of heat is sent up through the chimney that might be transmitted to the water with a lighter exhaust.

Intelligent supervision by men competent to judge the quality of coal, will effectually remedy this source of waste and cause of annoyance. Apart from the direct waste that results from an engine having the nozzles choked to burn inferior coal, there is the reduced efficiency of the engine to be taken into account, and the delays to train service incident to bad steaming engines. There is nothing that demoralizes the work of a division so thoroughly as an epidemic of bad steaming locomotives, and these epidemics are nearly always caused by the use of inferior coal. A curious thing connected with this fuel question is that the bad coal is nearly always charged at the same price as first-class coal.

We commend the change made by the Wabash to the attention of other railroad managers. The different division inspectors report to the general inspector, who is responsible to the general manager for the efficient performance of his duties. These inspectors are more likely to be good judges of coal than the parties to whom this duty has formerly been assigned, and their supervision will be an efficient guard against the delivery of coal which is inferior to what it has been represented to be.

Effect of Inside Valve Clearance.

The experimental work done on the locomotive "Schenectady," at Purdue University, and of the engines tested on the stationary plant belonging to the Chicago & Northwestern is steadily settling problems in the operation of locomotives that have long excited conflict of opinion. A question that has long been a subject of much dispute among master mechanics is, the economical effect of inside clearance of valves. A few locomotive men have insisted that a little inside clearance is conducive to economy of steam, especially for high-speed engines, while others held that it made a more powerful engine, but wasted steam. The tests of service were too inaccurate to demonstrate which side was right, but the prevailing practice was to give a little inside lap, or to have the inside valve edge line and line. This was the practical testimony of the railroad world on the subject; on the other side were a few engineers who had studied closely the details of steam distribution, and who were believers in the aid that the steam engine indicator gives in understanding the effects of changes in valve arrangements.

Purdue University and the Chicago & Northwestern testing plant have now presented evidence that inside clearance, within certain limits, not only makes a more powerful engine, but saves steam. Mr. E. M. Herr having made a statement to the Western Railway Club that the information gained in making tests on their stationary plant had induced the Chicago & Northwestern Railway to adopt the practice of giving the valves of their passenger engines 1/8 inch clearance, Professor Goss, of Purdue University, discussed the subject, and added facts ascertained by use of their engine. He held that no change in valve mechanism, or of valve proportions or valve setting, could produce any real effect upon the power of a locomotive unless it affects its efficiency. The fact that inside clearance gives a greater mean effective cylinder pressure is of no consequence, because that could be obtained by lengthening the cut-off. A locomotive will be most powerful when its engines are most efficient in the use of steam. He intimated that the work on the Purdue locomotive indicates that inside clearance reduces the consumption of steam at very high speeds, but that the saving was not very great. As the drain on the boiler is, however, greatest at high speed, it seems that this simple change in the valves is calculated to increase the efficiency of the engine.

The Latest "Fake."

There appears to have been some method in the madness of parties who got out the absurd Holman locomotive, which is mounted upon two pairs of trucks, one above the other.

They are advertising in Philadelphia papers that a company has been formed to sell this locomotive, the capital stock being $10,000,000. They offer to sell stock for $25 a share, the par value being $100. They make the claim that this sort of engine is destined to be the locomotive of the future, and make a great many other absurd claims for it.

Since Keeley motor stock is still quoted as being of some value, we have no doubt but what parties will be found foolish enough to put money in the Holman Locomotive Speeding Truck Company.

Neglect of Dampers.

A writer in our correspondence department, under the heading of "Defective Dampers—Waste of Coal by Reckless Firing," directs attention to some sources of waste of fuel which we are surprised goes on so long without correction.

Those who have paid attention to the economical use of coal agree that locomotive ash-pans ought to be fitted with good dampers, and that they should be used to regulate the admission of air or to cut it off when an engine is standing idle. The belief that dampers are made for this purpose is spreading slowly, and on some roads the enginemen are directed to use the dampers; but neglect of this duty is very common. The railroad companies are themselves to blame for the neglect of the men in operating dampers, because the levers for operating them are nearly always exceedingly awkward to move. They often come in contact with other appliances beneath the foot-plate, and have practically no means of holding the damper in different positions.

Until railroad companies begin to make the handling of dampers easy and convenient, they need not expect that firemen will interest themselves much in attending those appliances.

BOOK NOTICES.

"Practical Management of Engines and Boilers." Including Boiler Settings, Pumps, Injectors and All Connections of Engines and Boilers. A Practical Guide for Engineers and Firemen and Steam Users Generally. By William Barnett Le Van, Consulting Engineer. 267 pages; 4½ x 6½ inches. Philadelphia Book Co., Philadelphia. Price $2.

This little book is written by a practical boiler maker and mechanical engineer, and his purpose has been to make a useful handbook for engineers and firemen. In this he seems to have succeeded very well indeed. Men in charge of boilers and engines, looking for information concerning their engines, will find this as good a book as anything we know of.

"Tenth Annual Report of the Bureau of Labor Statistics of the State of North Carolina," for the year 1896. 254 pages; 6½ x 9½ inches.

This is the annual report, prepared for statement to the Governor of North Carolina by Mr. B. R. Lacy, labor commissioner. It contains a great deal of interesting information concerning labor in the State, and price paid for the same, the number of hours worked and the number of persons employed in various lines of industry. In connection with this report, we are glad to see that the wages paid by railroad companies to their employés are on a much higher average than that paid other industries. The report shows evidence of great painstaking in its preparation, and is certainly a credit to Mr. Lacy, who is an old railroad man and a highly competent engineer.

"Gas, Gasoline and Oil Vapor Engines." For Stationary, Marine and Vehicle Motive Power. By Gardner D. Hiscox, M. E. New York: Norman W. Henley & Co. 279 pages; 6 x 9 inches. Price $2.50.

This appears to be a very timely contribution on a subject that has been written about sparingly. Gas engines have been coming very rapidly into use for the last few years, and the indications are that their popularity will increase rather than diminish, and it has been very difficult finding books that would describe their operation in a way that an engineer or mechanic could understand. This book contains the information required, and it will be found a very valuable work of reference for those who have anything to do with gas or gasoline engines. It deals with all classes of engines, from the high speed engine, used for electric lighting purposes, to the tiny motor used for driving a tricycle.

"Bearings and Lubrication." A Handbook for Every User of Machinery. By A. J. Wallis-Tayler, C. E. D. Van Nostrand Co., New York. 208 pages; 5 x 7½ inches. Price $1.50.

Everybody connected with the use of machinery of any kind is liable to be directly interested in lubrication and, therefore, he is likely to find this book interesting and useful. The work is thoroughly practical in every respect, and has a great many good engravings of various forms of bearings and appliances for handling lubricators. It brings out in a very positive way, that it is not usually the amount of work done which causes a machine to wear out, but friction, due to the want of lubrication. That might be called the text of the book, and then it proceeds to present the proper remedies for the salvation of the machine. The parts relating to the application of lubricants to bearings and rubbing surfaces is remarkably full, and contains engravings of all the lubricators that we remember having seen in use.

"Steam Boilers." By Cecil H. Peabody, Professor of Marine Engineering and Naval Architecture, and Edward F. Miller, Assistant Professor of Steam Engineering; both of the Massachusetts Institute of Technology. John Wiley & Sons, New York. 380 pages; 6 x 9 inches. Price $4.

This book has been prepared for the use of students, but it will be found very useful for any person interested in the making of boilers, or in the care of them, It is written in a style that is comprehensible to any ordinary mechanic, is profusely illustrated by good cuts, and is not very heavily loaded down with algebraic formulae. It contains the best chapter on Types of Boilers we have ever read, and that on Shop Practices also strikes us as being particularly good. Among the other subjects treated are: Fuels and Combustion; Corrosion and Incrustation; Settings, Furnaces and Chimneys; Power of Boilers; Staying and Other Details; Strength of Boilers; Boiler Accessories; Testing Boilers; Boiler Design. Every chapter contains valuable information, that we do not think can be found so compactly stated anywhere else.

The "Proceedings of the 26th meeting of the American Society of Railroad Superintendents," held at Niagara Falls, September, 1896, has reached our desk. The volume is standard railroad size of 69 pages, and contains the reports submitted to the convention, with discussions upon them. The most important report and discussion was on the Progress in Signal Engineering.

PERSONAL.

Mr. Thomas R. Hill has resigned the position of superintendent of the United States Metallic Packing Company.

Mr. A. Sherman has been appointed foreman of the Dunkirk shops of the Dunkirk, Allegheny Valley & Pittsburgh.

Mr. J. P. Bey has been transferred from Denver to be general foreman of the Union Pacific shops at Laramie, Wyo.

Mr. F. H. McGee has been appointed master mechanic of the Georgia & Alabama, with headquarters at Americus, Ga.

Mr. D. Hickey has been appointed division master mechanic of the Union Pacific, with headquarters at Evanston, Wyo.

Mr. W. T. Gorrell has been promoted from assistant to be master car builder, in charge of the Philadelphia & Reading shops at Reading, Pa.

Mr. George R. Haskell, heretofore assistant superintendent, has been appointed superintendent of the Lima Northern, with headquarters at Lima, O.

Mr. T. H. Pendell has been appointed superintendent of the Greenwood Lake, New Jersey & New York divisions of the Erie Line, with headquarters at Jersey City.

Mr. Geo. E. Ayer has been appointed trainmaster of the San Marcial division of the Atchison, Topeka & Santa Fé. He was formerly a roadmaster on the same road.

Mr. J. H. Rankin, for several years master car builder in charge of the Philadelphia & Reading shops at Reading, has been appointed general storekeeper of that road.

Mr. H. E. Passmore, who has been roundhouse foreman of the Norfolk & Western, at Kenova, W. Va., has entered the employ of the Baldwin Locomotive Works.

Mr. J. S. Andrews has been appointed Western agent for the Falls Hollow Stay Bolt Company, with headquarters in the Royal Insurance Company Building, Chicago, Ill.

Mr. E. R. McCuen has been appointed general foreman, in charge of the mechanical department of the Lexington & Eastern Railway, with headquarters at Lexington, Ky.

Mr. W. P. Sparks, who was formerly identified with the tin plate business at Crawfordsville, Ind., will represent the Davis & Egan Machine Tool Company in Ohio, Indiana and Kentucky.

Mr. J. R. Barr has been appointed general manager of the Lexington & Eastern Railway, with headquarters at Lexington, Ky. Mr. Barr was formerly engineer of maintenance of way on the same road.

Mr. H. E. Van Housen, superintendent of the Idaho division of the Union Pacific, has been appointed superintendent of the Idaho division of the Oregon Short Line, with headquarters at Pocatello, Idaho.

Mr. E. M. McIlvain, formerly assistant to the president and purchasing agent of the Bethlehem Iron Company, has been appointed acting sales agent for the company, with headquarters at South Bethlehem, Pa.

Mr. John Gill has been appointed master mechanic of the Illinois division of the Chicago, Rock Island & Pacific Railway, with headquarters at Chicago. He was formerly general foreman of the shops at Horton, Kan.

Mr. J. B. Keefer has been promoted from the position of conductor to be superintendent of the Houston, East & West Texas, with headquarters at Houston, Tex. He was formerly conductor on the Ohio & Mississippi.

Mr. A. J. Cunningham has been appointed general foreman of the Chicago & Western Indiana Railroad at Chicago, in place of Mr. D. H. Albert, resigned. He was formerly an engineer in the employ of the Union Switch & Signal Company, at Chicago.

The death of Mr. Edward Ellis, president of the Schenectady Locomotive Works, has led to several changes of officials. Mr. William D. Ellis has been elected president; Mr. Albert J. Pitkin, vice-president and general manager, and Mr. A. M. White, superintendent.

We have a letter from Mr. Geo. F. Hinkens, secretary of the Master Blacksmiths' Association, wishing us to give credit to Mr. A. L. Woodworth, chairman of the executive committee, for the creditable manner in which the proceedings of the fourth annual convention were got out.

Mr. W. P. Huntley, Jr., has been appointed general air-brake instructor of the Chesapeake & Ohio System, with headquarters at Richmond, Va. Mr. Huntley is a mechanical engineer, and has had large experience in conducting tests on the road. He is considered an expert on air brakes and all lines of train mechanism.

Mr. W. G. Nevin has been appointed general manager of the Santa Fé's California lines, in place of Mr. K. H. Wade, deceased. Mr. Nevin has been purchasing agent of the Santa Fé for the last few years, and previous to that was assistant to Vice-President D. B. Robinson and served in that capacity on several other railroads.

We have to acknowledge a handsome invitation to attend the bridal of Mr. John Baker Michael, master mechanic of the Southern Railway at Knoxville, Tenn., to Miss Frances Beulah. We have long anticipated this event, and regret that the leading part of the "Locomotive Engineering" force was not able to be at Knoxville when the ceremony took place.

Mr. Edward N. Hurley, who has represented the United States Metallic Packing Company in the West for the past several years, has been promoted to the office of general agent of the company, in charge of all their manufactures, including the metallic packing, Gollmar bell-ringer, Dean track-sander, Chouteau pneumatic hammer, and he will have offices in Chicago and Philadelphia.

General Magee, for the last twenty-nine years president of the Fall Brook Railway Company, died in France last month. He had been in very delicate health for several years, and was travelling in the South of France in the hopes of recuperating his health, when he was stricken with his last illness. He was a very intimate friend of Edward Ellis, president of the Schenectady Locomotive Works, and they both passed away within a few days of each other.

Mr. C. M. Higginson has been appointed agent of the Atchison, Topeka & Santa Fé, with headquarters in Chicago. For the last two or three years he has been assistant to President Ripley, and before that held a similar position on the Chicago, Burlington & Quincy. He was at one time chief motive power clerk at Aurora, and is particularly well posted about railroad rolling stock matters for one who has not received the training of an engineer.

The many friends of Mr. F. D. Adams, of Boston, so long general master carbuilder of the Boston & Albany, will be pleased to learn that he was one of a party of pilgrims who started, about a month ago, for a visit to the Holy Land. His affection for that part of the world is only next to his love for attending the Master Car Builders' Convention, and he has determined to shorten his stay in Jerusalem, if necessary, to get back in time for the convention at Old Point Comfort.

Mr. K. H. Wade, for the last eight years general manager of the Southern California Railway, died suddenly of apoplexy last month. Mr. Wade entered railway service on the Toledo, Wabash & Western as telegraph operator, and rose through that branch to be division superintendent. He was for a short time a superintendent on the Chicago, Burlington & Quincy, and then returned to the Wabash to be general superintendent. In 1889 he left the Wabash to accept the position which he held at the time of his death.

Edward Ellis, president of the Schenectady Locomotive Works, died at his home in Schenectady, February 27th, aged 53 years. Mr. Ellis was the third son of Mr. John Ellis, one of the first presidents and largest stockholders of the Schenectady Locomotive Works. After Mr. John Ellis died, he was succeeded successively by his sons, John C., Charles G., and then Edward, who has just passed away. Mr. Ellis was a very generous man, and has been exceedingly liberal with the employés during the recent oppressed times. He had an unusually large railroad acquaintance, and was a very welcome caller with high and low.

Mr. Fred. J. Miller, editor-in-chief of the "American Machinist," sailed for Europe on March 31st, to look up the market and possibilities for American products in the line of tools and machinery, and to give us, incidentally, on his return, interesting points on foreign shop and machine tool practice.

Mr. Waldo H. Marshall, who has been for the last year editor of the "American Engineer, Car Builder and Railroad Journal," has been appointed to succeed Mr. E. M. Herr, as assistant superintendent of motive power and machinery of the Chicago & Northwestern. Mr. Marshall has been connected with railroad journals for the last eight years, and previous to that he was in the Rhode Island Locomotive Works, where he learned the machinist trade, and then went into the drawing office as draftsman. Mr. Marshall is very well known to railroad men, and his friends will congratulate him on entering railroad life in such a prominent position as that to which he goes.

"Easy Lessons in Mechanical Drawing and Machine Design." Arranged for Self-instruction. By J. G. A. Meyer. Fully illustrated. Arnold Publishing House, New York.

This is a book, 10 x 14 inches, coming out in monthly numbers, 50 cents each, payable on delivery. It is, without exception, the finest work of the kind we have ever examined. Mr. Meyer, the author, who was for years associate editor of the "American Machinist," is well known to railroad men on account of his writings on locomotive subjects, and his work entitled "Modern Locomotive Construction" is likely to be a standard work of reference on the subject for many years. The book on mechanical drawing is likely to be the best work on the subject ever published. It is very profusely illustrated with excellent engravings, and the description of drawing processes is given so very plainly that any schoolboy can understand the instructions. We have not examined a book for a long time that we can so cordially recommend to young mechanics and others who are anxious to acquire the art of mechanical drawing without the aid of a teacher.

A leading Scotch railway company has appointed a lecturer to give lectures in fashionable towns, regarding the beautiful watering-places in Scotland. Needless to say, the towns on whose beauty he lectures are all within reach of this particular company's line.

Historical Chart No. 4.

The four locomotives shown in our Graphic History of the Locomotive, Chart No. 4, show considerable development over those illustrated in the previous chart, but they still represent the period of experiment.

The "Lightning" is a Crampton engine, so called after the name of the original designer. This was the first Crampton engine built in America, but the type was largely used in Great Britain at one time, and it became the standard of the leading French railways. The "Lightning" was built in 1849, at Schenectady, N. Y., by the Norris Locomotive Works, for the Syracuse & Utica Railroad. The engine was finely built, but the boiler was too small. The "Lightning" was in use only about a year, but it made a speed record of 16 miles and 88 feet in 13 minutes and 21 seconds, or about 72 miles an hour.

The "E. H. Miller" was the first type of Baldwin engine. The first engine built by Matthias W. Baldwin, the "Ironsides," was modeled after an English pattern; but the "Miller," the second locomotive built by him, embodied the ideas of Mr. Baldwin as to what an American locomotive ought to be. There was for a time considerable rivalry between Mr. Baldwin and Richard Norris as to the best design, the leading difference between the two builders being that Baldwin put the drivers behind the firebox and Norris put them in front, as seen in the "Washington," shown in chart No. 3.

The "Campbell" locomotive was the first eight-wheel engine that afterwards became the American type, and is now more popular all over the world than any other form of engine. This form of engine was patented by Henry R. Campbell in 1836, and combined the ideas of both Baldwin and Norris, since one pair of wheels were placed in front and another pair behind the firebox. The light track of our pioneer railroads called for the best possible distribution of weight of rolling stock, on account of which the Campbell type of locomotive grew rapidly into popularity.

After the Campbell, the "Chesapeake" is the most important move in locomotive development. The railroad company that first experienced great need of very powerful engines was the Philadelphia & Reading. The coal traffic on that road developed very early, and the engine shown was designed in 1847, by Septimus Norris, and built by Norris Bros., to handle the coal trains on the road named. It is needless to say that this was the first ten-wheeler ever built. Fears were entertained at first that this engine would not keep upon the track, but there was no difficulty in this respect, and the reputation made by the engine in hauling heavy trains was so decided that the Pennsylvania Railroad Company immediately ordered twenty of the same type.

EQUIPMENT NOTES.

The Queen Anne Railway is having one engine built at the Baldwin Locomotive Works.

The Wason Manufacturing Company is building four passenger cars for the Erie Railroad.

The Mather Stock Car Company is having nine cars built at the Indianapolis Car Works.

Two ten wheelers are being built by the Baldwin Locomotive Works for the Southern Railway.

One engine is being constructed by Schenectady Locomotive Works for the Fitchburg Railroad.

The Um. Fernando de Terasa Railway is having one engine built at the Baldwin Locomotive Works.

The Northern Pacific Railway is having two engines built at the Schenectady Locomotive Works.

The Baldwin Locomotive Works are building two engines for the Sierra Madre Construction Company.

Eight engines are under construction at the Baldwin Locomotive Works for the Imperial Chinese Railway.

The Richmond Locomotive Works are building nine engines for the Charlotte & Western Carolina Railway.

Seven locomotives are in course of construction at the Baldwin Locomotive Works for the Erie Railroad.

The Baldwin Locomotive Works are engaged on eight engines for the Kansas City, Pittsburg & Gulf Railway.

Two engines are being constructed for the Spokane Falls and Northern Railway by the Baldwin Locomotive Works.

One engine for the Buffalo, St. Mary & Southwestern Railway is under construction at the Brooks Locomotive Works.

The Chicago, Hammond & Western Railway is having 240 freight cars built by the Haskell & Barker Car Company.

One engine is being built by the Baldwin Locomotive Works for the Nashville Chattanooga & St. Louis Railway.

Four hundred freight cars are being built for the Kansas City, Pittsburg & Gulf Railway by the Missouri Car & Foundry Company.

The Westinghouse Air Brake Company have put their instruction car at the disposal of the civil engineering department of the New York University, for their inspection.

The Norfolk, Virginia Beach & Southern Railway is having twelve passenger cars built by the Jackson & Sharp Company, and twelve freight cars built by the Union Car Company.

The Pittsburgh Locomotive Works are building seven locomotives for Japan.

They also have orders for some locomotives for the Valley Railroad and the Kansas City, Fort Scott & Gulf Railroad.

The Davis & Egan Machine Tool Company, of Cincinnati, have just received a large order from Stockholm, Sweden, for some forty machines, amounting to about $22,000; also a large order from Sheriff, Swingley & Co., of Johannesburg, South Africa.

The Bucyrus Company, of South Milwaukee, Wis., the reorganized Bucyrus Steam Shovel & Dredge Company, are now building for the Great Northern Railroad four 60-ton steam shovels, and for the Northern Pacific six 40-ton steam shovels. This, we believe, is the largest order for steam shovels ever placed on one contract.

Among recent orders received by the Ingersoll-Sergeant Drill Company, of New York, is one from the Atchison, Topeka & Santa Fé system for a large duplex air compressor to be used at the shops of the Gulf, Colorado & Santa Fé Railroad. The air cylinders of this compressor are cross-compound and of the well-known piston inlet type.

The Illinois Central have fitted up several locomotives with apparatus for taking indicator diagrams, and have put them at the disposal of the mechanical engineering department of the University of Illinois. Prof. L. P. Breckenridge is taking a great deal of interest in this work, and is trying to make it profitable both to the railroad company and to the students.

The Ministry of Communication has the intention of renting four Heilmann's electric locomotives for service on the Russian railways. Two of the locomotives are intended for express service, and each is expected to draw, on the level, a train of 380 tons at a speed of 62¼ miles per hour; the other two are to work goods trains, and each is to draw a load of 1,000 tons on the level at a speed of 26½ miles an hour. The Heilmann locomotive is a French invention, and is a huge apparatus that carries a boiler to operate electric machinery which furnishes the tractive power. It is an electric motor carrying its own boiler, engine and dynamos. We cannot see how it could be more efficient than a direct steam-driven locomotive.

The average wages paid to workmen in the Illinois Steel Company's Works last year was $2.23 per day. The average wages paid at Homestead, Pa., Iron Works, in the same period, was $2.90 per day. At the beginning of the year the Illinois Steel Company pretended that they could not make steel at a profit without cutting wages 10 per cent. They were getting $29 a ton for rails at that time. Rails are now selling at about $10 a ton less.

Ratio of Heating Surface Grate Area and Cylinder Volume.

BY ANGUS SINCLAIR.

The committee of the American Railway Master Mechanics' Association, appointed to investigate the ratios of grate area, heating area and cylinder volume, of which Mr. G. R. Henderson is chairman, has issued a circular which calls for answers to a great many questions. If responses are given to the questions by a large number of the members, Mr. Henderson will have on his hands a vast mass of information on which to base his report, but the subject is one which does not appeal to the fact-giving tendencies of the ordinary master mechanic, and we are inclined to believe that when the time for writing the report comes round, Mr. Henderson will be left pretty much to his own resources for securing the necessary facts on which to base a report.

Those who selected this subject directed the committee to extend their investigations for engines in both passenger service and freight service, and to find out, whether burning anthracite coal or bituminous coal, what should be the ratio of grate area, heating surface and of cylinder volume. They were also required to find out the proper ratio between cylinder diameter and length of steam port.

Recent practice has demonstrated such a great variety in the ratios of grate area and heating surface to cylinder volume, that merely finding out the most common proportions in vogue will not give information of much value. It will be necessary to demonstrate the proportions that produce the most economical locomotive for different kinds of service.

We submit a table, giving the leading particulars concerning 25 of the latest built locomotives, and it will be seen that there is very great diversity in the ratios that have to be investigated. Six of the locomotives are hard coal burners, sixteen are American engines built for burning soft coal, and three are foreign locomotives, also soft coal burners.

The ratio of heating surface to each cubic foot of cylinder content varies from 264 square feet in the latest Lake Shore engine to 129.11 square feet, in the most approved form of locomotive built for the North Eastern, of England. The ratio of grates in these engines to one cubic foot of cylinder content is 3.87 and 2.22 square feet, respectively. Among the soft coal burning engines, the latest L type for the Pennsylvania has 4.08 square feet of grate area to one cubic foot of cylinder content, the highest on the list; while the latest Chicago, Rock Island & Pacific passenger locomotive and the Pennsylvania Class O have each only 2.5 square feet of grate area per cubic foot of cylinder content. Foreign locomotives, of which particulars are given, are among the latest designs in Great Britain, and are noted for their efficiency, yet the ratio of heating surface to cylinder volume is decidedly less than anything to be found in this country among recent designs.

The "999" class of New York Central passenger engines, which have been famous for the economical and efficient work performed, have 235.52 square feet of heating surface and 3.47 square feet of grate area per cubic foot of cylinder volume; while the "Dunalastair" class of engines, designed a year ago for the Caledonian Railway, of Scotland, to beat the train hauling record in Great Britain, have 184.65 square feet of heating surface and 2.62 square feet of grate area per same unit.

In analyzing the proportions of all the engines, we are surprised to find that the ratio of heating surface to cylinder volume is smaller in hard coal burning engines than in those designed to burn bituminous coal. The average of six hard coal engines is 201.2 square feet of heating surface to the cubic foot of cylinder content, and 5.5 square feet of grate area to the same unit. The sixteen American soft burning engines have an average of 227.75 square feet of heating surface and 3.25 square feet of grate area to the unit above mentioned. The three foreign locomotives, of which particulars are given, have an average of 156.09 square feet of heating surface and 2.39 square feet of grate area per cubic foot of cylinder volume.

It is to be supposed that the designers of all the modern locomotives considered the ratios of heating surface and grate area to cylinder volume, to be the best for economical performance of the engines, yet, it is difficult to reconcile the idea that the engine with 181.8 square feet of heating surface and 2.5 square feet of grate area will supply steam as economically to the unit of cylinder, as an engine having 264 square feet of heating surface and 3.87 square feet of grate area. Opinion in the locomotive engineering world is greatly in conflict as to the proper proportions of grate area to the heating surface, but there is a general tendency to believe that both the heating surface and the grate area should be made as liberal as possible; but when the theories of good designing are reduced to practice, we meet with curious paradoxes. With its 264 square feet of heating surface and 3.87 square feet of grate area per unit of cylinder capacity, the Lake Shore engine ought to be much more economical than the Pennsylvania Class O. with its 181.81 square feet of heating surface and 2.5 square feet of grate area per same unit; but we understand that both give about the same service for the amount of coal used.

It would be edifying for railroad men to obtain particulars about the relative economy of the Classes O and L on the Pennsylvania Railroad, while performing the same work. Class L was designed for burning anthracite coal, but the engines are using bituminous coal and doing the work with an unusually small consumption of coal.

The performance of British locomotives, with their comparatively limited heating surface and grate area, makes the difficulty of deciding upon what proportions are best, exceedingly hard to determine; but it is safe to say that few locomotives in Europe, pulling passenger trains, consume the amount of fuel burned by American engines performing equal work. There are very few express locomotives in this country that do their work with less than 50 pounds of fuel per train mile, although there are a few striking exceptions.

The writer rode upon the Caledonian Railway Company's locomotive "Dunalastair" last summer, when it was pulling a train of 604,688 pounds, or a little over 302 American tons, and with engine and tender, a total of 791,644 pounds. The speed maintained was a little over 50 miles an hour, and an ascent of 1,000 feet had to be made in the first 50 miles. The coal consumption of the engine was not over 38 pounds per train mile. The fuel used was Scotch coal, which is quite inferior to our best coals, and has about the same value for steam making as the ordinary line of Illinois coal. The passenger locomotives on English railways, where a highly superior kind of coal is burned, very rarely exceed 30 pounds of coal to the mile, when pulling a train of 250 tons at 50 miles per hour. The Manchester, Sheffield & Lincolnshire engine, whose dimensions are given, does the work with 24 pounds of coal to the train mile. It is safe to say that there are none of our engines that can come up to this measure of economical working.

We do not believe that the inferior record made by American engines is due to steam-making parts. Our boilers, with their ample grate area and heating surface, must be more efficient than those used abroad. The steam-using parts possess capabilities of waste which are thoroughly worthy of investigation. Our designers have steadily gone on increasing ratio of cylinder clearance to cylinder capacity, and the valve travel has been steadily made longer. It is not a certainty that the radical difference in our engines and those found abroad, in this respect, is the cause of the difference in economy; but it would be a valuable work of investigation to find out the real facts in the case. The ordinary run of British locomotives have steam ports ranging in length from 10 to 13 inches, and valve travel is generally under 5 inches. In the course of an extended search, the longest steam ports the writer found on the continent of Europe, were 13 inches, and the engine had cylinders over 23 inches diameter and 28 inches stroke. The small ports appear to admit to the cylinders all the steam required for doing the work, and they certainly give a smaller proportion of cylinder clearance than the huge ports and passages which are used by nearly all American locomotives. Our locomotives are as successfully and intelligently handled as any engines on wheels. The cause of their comparatively high consumption of fuel must, therefore, be charged against the machine itself.

It appears to us that the designers of our locomotives are influenced too much by the principles which regulate the port proportions of stationary and marine engines. They endeavor to make the port openings agree as nearly as possible to automatic engine practice, and ignore the fact that entirely different conditions have to be met. The steam ports of stationary engines are nearly always close to the ends of the cylinders, and entail but small clearance space, while steam ports of locomotives, on the other hand, are remote from point of admission to the cylinder and are frequently made unnecessarily distant by high valve seats. The result of this is that we have few locomotives with clearance less than 10 per cent. of the piston displacement, and many of them are considerably more. When cutting off short, it takes, in some cases, nearly 50 per cent. of the steam admitted to fill the clearance spaces.

When this source of steam waste is pointed out, nearly all designers meet it with the explanation, that the clearance spaces are entirely filled up by the act of compression, and therefore there is no real loss of steam. We have, until lately, been willing to admit the force of this reasoning, but after examining some indicator diagrams presented by Mr. Quereau in his paper on valve lead, read before the Western Railway Club, we have obtained new light upon the subject. It is clearly shown in that paper that the projecting upwards of the compression line above the initial pressure is not due to the steam confined in the cylinder, but to the steam port being opened too early. While railroad men have been preaching these many years that ample piston clearance is necessary to prevent undue compression and to make a locomotive run smoothly, the defects they were attempting to guard against were due to excessive lead. It seems to us that the discovery made by Mr. Quereau is destined to exercise very important influences in preventing waste of steam in locomotive cylinders.

There appears to be great confusion of ideas among our master mechanics, concerning the effect of large clearance spaces and of different sized steam ports. Quite a number of years ago there was considerable agitation in favor of shorter steam ports on account of the performance of the Eddy engines on the Boston & Albany, which were noted for their short

ROAD.	Type.	Cylinders—inches.	Diameter of Drivers.	Boiler Pressure.	Weight. On Drivers	Weight. Total.	Tractive Power per pound of M. E. P.	Heating Surface. Fire-box—sq. feet.	Heating Surface. Tube—sq. feet.	Heating Surface. Total—sq. feet.	Grate Area.	Displacement cylinder in cubic feet.	Ratio of Displacement of cub. foot of Cylinders to Grate Area and Heating Surface. H. S. Fire box.	H. S. Tubes.	H. S. Total.	Grate Area.
*New Jersey Central	8-W.	20 x 24	78	180	82,000	123,800	123.2	166.0	1,530.0	1,696 0	38 5	8.72	19.04	175 46	194 50	4.42
*Lehigh Valley	8-W.	20 x 24	66¼	140	63,000	90,720	145.6	142.0	1,430.0	1,572.0	39.2	8 72	16.28	163.99	180.27	4.49
*Lehigh Valley—Latest	8-W.	19 x 26	76	180	81,800	140,950	133.3	148.98	2,081 24	2,230.22	63.97	8.53	17.47	243.99	261.46	7 50
*Erie	8-W.	19 x 24	68	150	84,400	117,400	127 4	160.5	1,470.5	1,631.0	39.94	7.88	20.37	186.61	206 98	5.07
*Pennsylvania—P	8-W.	18½x 24	68	160	67,800	100,600	120.79	138.0	1,244.0	1,382 0	32 25	7.47	18.47	166.53	185.01	4.32
*Del., Lack. & Western	8-W.	18½x 24	69	160	74,455	106,000	119.0	137.0	1,200.0	1,337.0	35 0	7 47	18.34	160 64	178 98	4 69
Baltimore & Ohio—M	8-W.	20 x 24	78	....	77 000	114,500	123.7	143.45	1,544.0	1,687.45	25 0	8.72	16.45	177.06	193 51	2.87
Baltimore & Ohio	10-W.	21 x 26	62	.....	103,000	133,000	184.9	188.5	1 846 8	2,035.4	28.2	10.42	18 09	177.22	195 31	2.71
Norfolk & Western	10-W.	19 x 24	60	....	97,800	123 800	144 4	151.0	1,776.7	1,927.7	29.0	7.88	19 16	225.47	244.63	3 68
Union Pacific	8-W.	19 x 24	69	180	81,025	119,600	125.6	113.3	1,672.2	1,815.5	26.2	7.88	18.19	212.21	230.40	3.33
Norfolk & Western—N	8-W.	18 x 24	62	.....	75,175	101,050	125.4	141.8	1,470.0	1,611.8	18.5	7 07	20.08	208.2	22 .28	2.62
Chic , R. I. & Pac	8-W.	18 x 24	68¾	.....	69 800	107 3 0	113.1	145.0	1,336.7	1,481.7	17 6	7 07	20.54	189.31	209.85	2.5
Pennsylvania—O	8-W.	18 x 24	68	160	61,450	98,300	114.3	127.6	1,156.0	1,283.6	17.6	7.07	18.07	163.74	181.81	2.5
Pennsylvania—L	8-W.	18½x 26	80	185	134,800	....	111.2	148.0	1,746.6	1,894.6	33.0	8.08	18.3	216.16	320.1	4.08
Chic., Bur. & Quincy	Mogul	19 x 24	68	160	94,500	113 000	127.4	126 0	1,380.0	1 506.0	27.1	7 88	16.03	175 57	191 6	3.45
N. Y., N. H. & Hartford	8-W.	20 x 28	63	190	... .	144,200	177.77	164 38	1,946.72	2,111.1	30.22	10.18	16.17	192.61	217 78	2.97
Bur., Cedar Rapids & North	10-W.	18 x 26	69	180	108,000	137,000	124.0	169.9	1,465.0	1,634.9	24.7	7.66	22.09	191.5	213 59	3.23
Lake Shore	10-W.	18 x 24	68	190	88,000	118,000	114.35	135.3	1,731.3	1,866 6	27.35	7.07	19.12	244.88	264.0	3.87
Boston & Albany	8-W.	19 x 24	69	190	74,000	114,700	125 56	141.4	1,703.3	1,844.7	2[illegible].3	7.88	17.99	216.70	234 69	3.22
N. Y. Central—Class 999	8-W.	19 x 24	87	180	80,000	120,000	99.01	166.8	1,684.5	1,851.3	27.35	7.88	21.2	214.32	235 52	3.47
N. Y. Central—Latest	8-W.	19 x 24	78	190	90,000	136,000	111.0	171.18	1,809.56	1 980.72	30.69	7.88	21.77	2 0.23	252.0	3.90
Clev., Cin., Chic. & St. Louis	8-W.	18½x 24	68	180	79,700	119,600	120.73	138 1	1,587.5	1,725.6	28.0	7.47	18 48	212.45	230.93	3.75
Man , Sheffield & Lincolnshire	8-W.	19 x 26	84½	175	....	.	111.73	109.0	1,209.0	1,318 0	20 0	8.53	12.78	141.73	154.51	2.34
North Eastern	8-W.	20 x 26	91¼	180	37,400	101,600	113.97	130.0	1,090.0	1,220 0	21.0	9.45	13.78	115.34	129.11	2.22
Caledonian	8-W.	18¼x 26	78	160	69,504	104,504	111 0	138.78	1,314.45	1,453.23	20 63	7 87	17.63	167.62	184.65	2.62

* Hard coal burners.

ports and economy in the use of steam. In talking with a most intelligent master mechanic lately on this subject, he insisted that there was no economy in using short steam ports, for he had demonstrated this to his own satisfaction about the time the short port agitation was at its hight. His method of demonstrating the thing was, that he put pieces of metal into the steam ports to shorten them up to smaller dimensions. He watched the effect of this very carefully, and was unable to tell any difference in the coal consumption of the engines, consequently he reasoned that there could be no saving from having shorter ports. He ignored the important point, however, that by shortening up his ports, he did not materially lessen the clearance spaces. A test of that kind demonstrated absolutely nothing.

The only proper test to find out the effect of long and short ports would be to make an engine the same in every respect to others of a class, but make the cylinders with small ports and admission passages. It is generally acknowledged that there is no difficulty in getting the steam into a cylinder fast enough through contracted openings—the great difficulty is in getting it out at high piston speeds. If it is considered desirable to make the exhaust port longer, so that the steam could escape freely, there would be no difficulty in leaving it of ample length, and making the steam ports short, but it seems needless to make an exhaust port with 45 square inches of area to pass out steam that goes through a nozzle with 8 or 9 square inches of opening.

American locomotives of a given size of driving wheel can force a train into high speed much more rapidly than foreign engines, and their capacity for fast running is much greater, but the owners may be paying too high a price for these characteristics.

The most important event of last month, so far as railroad interests are concerned, was a decision rendered by the Supreme Court, declaring the Trans-Missouri Association to be a violation of the Interstate Commerce Law. Five out of nine judges acquiesced in this decision; the other four thought that the association was perfectly legal. The decision is a blow to railroad interests, and will encourage the ruinous competition which has repeatedly pushed rates below cost and brought disaster to every railroad interest.

We have received a catalog of Eberhardt's Patent Shapers and Various Attachments, sent out by Gould & Eberhardt, Newark, N. J. It is a small book, convenient for the pocket, and contains illustrations and price list of all the shapers made by the concern.

WHAT YOU WANT TO KNOW

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(21) G. W. V., Bennett, Pa., writes for one of our Traction Power Computers and asks if the diameter of drivers means the outside diameter of tires. A.—The outside diameter of the tire is always understood as the diameter of a driving wheel.

(22) H. W. E., Rockland, Me., asks: Why are not piston valves more used on locomotives? A.—The reason why piston valves are not more generally used is ascribed by those who have tried and found them wanting, to the losses due to leakage, and the consequent expense involved in keeping them tight. The cost of maintenance is said to overbalance their advantages in reducing friction.

(23) A. E. H., Americus, Ga., writes: When slide-valve strips are blowing on account of springs breaking, or are defective on account of wear, what position can engine be placed in so as to tell which side is blowing? A.—A reference to pages 618, 619 and 624 of the July, 1896 issue, also to page 684 of the August issue, where this subject is clearly discussed, will give you the information required.

(24) "Subscriber," Chicago, makes the request that we publish a letter on "Fuel Saving" which he sent us. A.—We wish to direct the attention of "Subscriber" and others that we publish no letters that do not give the name of the writer. Further, we wish to say that communications sent in without the name and address of the author are consigned to the waste basket at once, no matter what department they refer to.

(25) C. H. W., Baraboo, Wis., writes: There is considerable discussion in regard to a question that is asked in the first year's "Examination for Firemen." It is this: "How is steam generated, and in what manner does it transmit its power to the locomotive?" What I wish to know is the proper answer to the part of the question as to how power is transmitted to the locomotive. A.—The energy of the steam in the boiler is exerted on the pistons, forcing them into a reciprocating motion, which is converted into a rotating motion at the wheels, by means of the piston's connection with the crosshead, rods and pins.

(26) J. N. F., McGraw, Pa., writes: Will you please state if vacuum in an engine cylinder causes the snap ring packing to shrink away from the walls of the cylinder, or does it expand the rings the same as pressure does? A.—A vacuum is defined as "a space devoid of matter"; the rarefaction or reduction of pressure below that of the atmosphere depending on the means of producing exhaustion. Since a vacuum is a space devoid of pressure, it is difficult to conceive of a force therein sufficient to overcome the elasticity of the piston rings and pull them away from their bearing against the bore of the cylinder. Vacuums do not affect piston rings either to contract or expand.

(27) J. W. D., Delta, La., asks: What distance would a wheel 84 inches in diameter travel in one revolution. Some say a fraction under 22 feet, while others claim it will only travel a small fraction over 21 feet. Please give the correct distance such a wheel should travel in one revolution. A.—The ratio of circumference to diameter is always as 3.1416 is to 1, that is, when the diameter is 1, the circumference is 3.1416, let the unit be what it will. The 84-inch wheel is 7 feet in diameter, therefore, $3.1416 \times 7 = 21.99$ feet, which is 0.01 of a foot, or 0.12 inch less than 22 feet. Anybody who can work the elementary rules of mensuration should be able to answer such questions for themselves.

(28) W. G. C., St. Louis, Mo., writes: A six-wheel connected 18 x 24 engine having machinery heavy enough for a 19 inch cylinder, but in good condition, except that the main rod was down and the valve stem disconnected, with ports covered on the right side; in being placed on the turn table by a hostler, it was found that the good side of the engine came too near the center to handle herself and balance on the table. The hostler ran the engine ahead and slipped her a quarter of a turn, after which he set her in the proper place without any further trouble. I would like to know if there was any danger of pulling off the main pin on the left side, with all the side rods and wedges in good condition. A.—Under the conditions, we answer no to the question, but it must be understood that the slipping of an engine is a reprehensible practice, particularly when partially disconnected.

(29) R. S., Philadelphia, Pa., writes: I have to cut a screw ⅝ inch diameter, 5 inches long, 100 threads to the inch. I used a single cutting tool but could not get the thread smooth enough. I then made a circular chaser, but the thread was still rough. Please say in what way this kind of work is usually done. A.—You have not stated what material the screw is made of. Assuming it is steel, your trouble can be traced to a very common difficulty in screw cutting on steel, namely, annealing the piece so that it is hard on one side and soft on the other. If the piece is equally soft all through and you cut the thread with a series of cuts, just as would be done with a coarser pitch screw, there should be no difficulty in getting a good job. The requisites to do this are: An oil stoned cutting edge on the tool, a good lathe, and judgment. A hand magnifier is also a good thing to use when cutting fine pitch screws.

(30) J. S. C., Saginaw, Mich., writes:

1. The road I am on uses a poor quality of coal, and our stacks are short—5 feet 4 inches only from the arch. Our engines throw smoke and cinders. Now the question I want to ask is this: Cannot these stacks be raised to 6 feet high without affecting the steaming of the engines for the worse? There are no tunnels or bridges on the road to obstruct the hight. A.—The stack can be raised without doing any harm to the steaming of the engine, but if the purpose is to do away with the smoke and cinders, such a procedure will fail of its object. The fireman is what wants regulating so far as the smoke prevention is concerned, and a proper adjustment of the netting and deflector plate will reduce the cinder nuisance. 2. What is the standard hight for stacks on roads where there is no limit to hight from rail? A.—There is no accepted standard; stacks will range all the way from 36 to 60 inches, the latter figure being more generally in use perhaps than any other.

(31) W. E. E., Denver, Col., asks:

Will you please give the formula for finding the necessary working pressure which will cause the driving wheels to overcome the adhesion between the wheels and rails, taking the average conditions of track and engines in railway yards? A.—The adhesion of a locomotive on a dry rail has been found by experiment to be about one-fourth of the adhesive weight, that is the weight holding the wheels to the rails. In yards the rails are more or less greasy, therefore the adhesion may be expected to be less than when the rails are dry, and a co-efficient of adhesion of 0.25 can be regarded as the highest that can be had in yard service, without more satisfactory data for a guide. This ratio of adhesive weight to adhesion will then represent the tractive power of the engine, since any tractive effort equal to the adhesion will slip the wheels. If the adhesive weight is 60,000 pounds, the adhesion would be $60{,}000 \div 4 = 15{,}000$ pounds, and since this is also the tractive power, a boiler pressure that will give this power is the pressure that will overcome the adhesion. Our article on "Drawbar Pull" in the November, 1896, number, to which you are referred, explains how to calculate the tractive power of simple and compound engines.

(32) A. J. C., Janesville, Wis., writes:

Will you please answer the following questions: 1. Given a crown sheet 8 feet long and 4 feet wide, with crown bars 5 x 3/4 inches, welded at the ends, and having 7/8-inch rivets 4 1/2 inches pitch. If no braces were attached from the crown bars to the wagon top, would the crown sheet be forced away from the rivets, or would the bars collapse with the crown if sufficient pressure were applied? A.—To determine where failure would first occur, it is necessary to investigate the tensile strength of the rivet, and the transverse strength of the crown bars. Assuming a boiler pressure of 140 pounds, the total load supported by one bar and its rivets equals $4.5 \times 48 \times 140 = 30{,}240$ pounds. With the width of crown and pitch of rivets as stated, there will be ten rivets, having an area of 0.6 square inch each, or a total area of $10 \times 0.6 = 6$ square inches for all rivets in one bar. Dividing the total load by the total area, we have, $30{,}240 \div 6 = 5{,}040$ pounds per square inch tensile stress on the rivets. The load on the crown bar is, of course, equal to that on all the rivets, and the bending moment due to that load uniformly distributed is found by calculation to be equal to 151,200 inch pounds. The fiber stress for this bending moment, also calculated, is found to be 23,924 pounds per square inch. From these figures it is seen that the crown bars would fail long before the ultimate strength of the rivets was reached. 2. What pressure would produce collapse? A.—A boiler pressure of 260 pounds per square inch would give a bending moment of 280,800 inch pounds and cause a fiber stress of 44,400 pounds per square inch, which is the ultimate strength of ordinary iron, but as shown above, the stress of 23,924 pounds, which was produced with 140 pounds boiler pressure, would cause failure because it is quite up to the elastic limit of the material, and safety demands that the elastic limit shall not be exceeded. 3. Give factor of safety for bursting pressure by the following rule: Multiply the tensile strength in square inches by the thickness, and divide by radius in inches, using 56 per cent. for single riveted seams, and 70 per cent. for double riveted seams. A.—The above formula has no application to flat stayed surfaces. A factor of safety indicates the number of times that a load may be multiplied before the ultimate strength of the resisting material is reached. In the case of the rivets, it was found that the unit stress was 5,040 pounds. If the stress of 44,400 pounds per square inch be taken as the ultimate strength of the material, then the factor of safety for the rivets would be $44{,}400 \div 5{,}040 = 8.8$. In like manner the factor of safety of the crown bars is found to be equal to the ultimate strength divided by the unit stress, or $44{,}400 \div 23{,}924 = 1.85$. A good work for a boilermaker who desires to be at the front is "Wilson's Treatise on Steam Boilers," and also "Steam Boiler Construction," by W. S. Hutton. These books are listed in our educational series.

We notice in an English railway paper a strike among warehousemen in which "rullymen," "capstanmen" and "chocker lads" took a prominent part. Since we read that paragraph, we have felt melancholy about the condition of our vocabulary of English words.

Steel-Tired Wheel Combination.

Various steel-tired wheel companies of the country have suffered very severely during the last four years, from severe competition to secure the small orders that railroad companies were giving out. In order to secure a living price for their product, several of the leading men in this business have been working for some time to establish a combination, and now they have formed the Steel-tired Wheel Company to control the entire steel car-wheel product of the United States and enough of the European output to prevent competition. The new company is incorporated under the laws of New Jersey, but will have headquarters in New York City. The officers are J. E. French, president; W. W. Snow, first vice-president; C. H. Antez, second vice-president; J. C. Beach, treasurer, and W. H. Silverthorn, general manager. There are nine steel-tired plants in operation in the United States, and practically the only foreign competition is that of the Krupp works of Germany, represented in the United States by Thomas Prosser & Son, of New York. The latter concern will take an interest in the new company. The concerns over which the new company has secured entire control are the Allen Paper Car-Wheel Company, of Pullman, Ill., and Hudson, N. Y.; the Paige Car-Wheel Company, Cleveland, O.; the National Car-Wheel Company, Buffalo; the Ramapo Car-Wheel Company, Ramapo, N. Y.; the Washburn Car-Wheel Company, Hartford, Conn., and the Boies Steel-Wheel Company, Scranton, Pa. The Standard Company, of Philadelphia, has persistently refused to join the new combination, and the Taylor Car-Wheel Company, of High Bridge, N. J., while not a member, is understood to have a close working agreement with the new company.

The draftsmen employed in the Baldwin Locomotive Works, held what they called their "Second Annual Belshazzar" lately. Some of the artists of the drawing office made an illuminated menu for the occasion, which is very artistic in appearance. According to this piece of art work, the menu consisted of "Monkey Tail Soup; Fish Plates, with Hot Glue; Pickled Bell Tongues; Steamed Nigger Head, casehardened, Pitch Sauce; Crow Feet on Foot Plates; Sliced Bull Nose; Roast Pig Iron in Alcohol; Hydraulic Ram for non-imbibers; Electric Cranes with Goose Necks, Window Jam; Nuts, Acorns, Scales, Tallow, Asbestos, Putty, Axle Grease." The drink is reported, "Alcohol, Kerosene, Turpentine and Benzine." A picture of Little Egypt, in character, is on the menu, with an intimation, that owing to a previous engagement she will not appear. There is also on the illuminated menu an acrostic, reading, "Baldwin Locomotive Works."

We have received from the Buffalo Forge Company an 8-page catalog, printed in Spanish, illustrating the line of blacksmith tools this company manufacture. They appear to make a specialty of sending these circulars, for they have recently mailed over 200,000 copies to the Canadian and American trade, and this one is intended for Mexico.

The Hancock Inspirator Company, Boston, Mass., has issued a new illustrated circular, giving particulars about the different water moving apparatus handled by the company. Besides descriptions of the inspirator and its method of working, there is useful information supplied concerning the operating and care of inspirators.

It is said that the Vanderbilt system of railways will establish in Buffalo a home for aged and infirm railway employés. No definite plans have yet been announced, but it is said that the project has been under consideration for some time, and that Buffalo has been selected as the best possible location for such a philanthropic institution. The home will care for and shelter all aged and infirm railway men who have grown old in the service of the Vanderbilt roads.

"Air Compressors" is the title of an illustrated catalog sent out by the Ingersoll-Sergeant Drill Company, of New York. It is got up in very handsome style, with first-class engravings, showing details of the various air compressors, drills, etc., manufactured by the company.

Hilles & Jones Company, Wilmington, Del., have issued a new illustrated catalog, showing recent designs of tools for working iron and steel plates, bars and structural shapes. It is a large book, 9 x 12, and tells the story of the tools in graphic form, by means of handsome engravings. It is the kind of a publication that gives a mechanic pleasure to look over, and no description is necessary to convey to his mind the sort of tools he is looking at.

A particularly fast run was made last month over the Plant System, when 108 miles were covered in 90 minutes. On one stretch of the road, a speed of 80 miles an hour was kept up for eight miles. A notable thing about this run was that it was made by ordinary locomotives, without any special preparation, just the same as the famous run previously made on the Chicago, Burlington & Quincy.

Anyone wishing to sell bound volumes of "Locomotive Engineering" for any year previous to 1893, can find a purchaser by addressing J. D. Daggett, 110 Island street, Chippewa Falls, Wis.

Meeting of the American Foundrymen's Association.

It is announced that the second meeting of the above named association will take place in Detroit during the second week in May. The association will at that time be one year old, and the preliminary organization will then be completed. The association now has about five hundred members, and its work so far has been successful.

Previous to this meeting, Messrs. W. H. Pfahler, of Philadelphia; Wm. Yagle, of Pittsburg, and E. H. Putnam, of Chattanooga, will meet and endeavor to formulate a plan for organizing an association of foundrymen to deal with labor difficulties, something on the lines followed by the stove manufacturers.

Another committee, which will consider the apprenticeship matter, and will endeavor to prepare a plan for a standard apprenticeship system adapted to the different branches of molding, such as agricultural, machinery and stove molding, consists of the following members: C. S. Bell, of Hillsboro, O.; R. Viall, Providence, R. I., and Wm. Ferguson, Chicago.

The Board of Directors of The Davis & Egan Machine Tool Company, of Cincinnati, held their annual meeting February 20th, and elected the following officers for the ensuing year: Chas. Davis, president; W. H. Burtner, vice-president and treasurer; B. B. Quillan, secretary. They declared a dividend of 3 per cent. out of the earnings of the past three months. The company report having done a very heavy foreign business during the past six months, and to have added to their shop equipment, some $34-000 worth of machinery. They have made many important alterations in their buildings, and are now erecting a large warehouse, in which to store all surplus tools as soon as a lot is finished, which will give them hundreds of feet of floor space in their regular shops for manufacturing purposes, heretofore used as storage.

The Star Brass Manufacturing Company, of Boston, Mass., have put on the market a very useful gage for air-brake inspectors. It can be applied to the hose coupling at the rear of any train, and instantly shows what pressure is on the train or signal pipes. The size of the test gage is only 2½ inches in diameter, and weighs less than one pound, so that it can be carried conveniently in the inspector's pocket. We understand that railroad companies are rapidly adopting this gage.

Gould & Eberhardt of Newark, N. J., have sent out a small illustrated catalog called "Gear Cutters and How to Grind Them." Every mechanic who has to grind gear cutters of any kind, will find useful information in this little book, which will be sent on application.

The Boston Belting Company has sent out a small illustrated catalog concerning garden hose. As the days for lawn sprinkling will be upon us soon, this catlog appears at a suitable time. It contains information and circulars about all kinds of garden hose and their adjustments, and useful hints are given as to how the same may be repaired. Those interested in these things should send for this catalog to James Bennett Forsyth, 260 Devonshire street, Boston, Mass.

They have just finished the erection of a new boiler shop for the Baldwin Locomotive Works. They are equipping it with the most approved machinery in the market and with several machines specially designed for the shop. The prediction is made by those who are in a position to know that this will be the finest boiler making shop in the world. The shop will contain no less than seven traveling cranes.

The necessity for having two men on a motor which hauls passenger trains, was illustrated in a melancholy way on the Panhandle last month. Charles Brown, an engineer running a passenger train, died while sitting on his seat in the engine. His fireman noticed that something was wrong, and stopped the train before any accident happened.

The latest ten-wheelers built by the Schenectady Locomotive Works for the Michigan Central are reported to be doing remarkably good work in pulling the heavy fast trains for which the road is noted. On a recent occasion a train was late and one of those engines ran 21 miles in 18 minutes with eight coaches.

A French scientist has been making practical experiments with pigments most suitable for the protection of structural iron work, and he found paint of graphite and boiled linseed oil to be the best. The Dixon Crucible Company, Jersey City, hold that this is the indorsement of their Dixon silica graphite paint.

The East Coast road, running between London and Aberdeen, have recently put a new corridor car upon their through trains. It is of the American type, 70 feet long, and is furnished with Gould combined vestibule and automatic couplers and buffers and the quick-acting Westinghouse brake.

The Bethlehem Iron Company have recently finished what is probably the finest plate mill in the country, and they are now prepared to supply all kinds of steel plates for railroad purposes. All the plates manufactured are from open-hearth steel, and are of very high quality.

Baltimore & Ohio Improvements.

A statement issued by the press agent of the Baltimore & Ohio says that from March 1, 1896, to February 1, 1897, the receivers have expended almost seven millions of dollars on locomotives, passenger and freight equipment, extraordinary repairs to equipment and expenditures made by the engineering department in the way of improvements to the maintenance of way, structures, terminals, and the construction of new alignments and miscellaneous improvements. It is shown that the betterments to locomotives amount to $18,000; the new equipment, which includes new dining cars and other passenger cars and betterments, amounts to $86,000; the new freight cars built by the road, and the repairs to those already in service, amounted to $147,000, the total being something over $250,000. The 5,000 new freight cars and the 75 locomotives which were added to the equipment last summer cost about $3,300,000 in round numbers. The extraordinary repairs to locomotives, passenger equipment and freight equipment aggregate $1,348,000; the total expenditures in the motive-power department being within a few thousands of five millions.

The Burlington has gone into the farming business, with the hope of inducing farmers to raise something else besides corn. Five stations have been selected in Illinois, Iowa, Kansas, and Nebraska, at each of which it will have a 40 acre field Soil culture is the prime object in view, and men who are supposed to be thoroughly informed on the subject, will be engaged to take charge of the fields and cultivate them to their capacity for any particular production. The company expects, with an intelligent preparation of the soil, to produce crops of different products from which a paying revenue may be realized.

The general passenger agent of the Mobile & Ohio Railroad is sending out an advertising hanger, which is unique in its kind. On a blue ground there are designs and different colored type work, intimating that the lands along the line of the Mobile & Ohio Railroad are the most productive in the South. The popularity of the hanger may be judged from the fact that 250,000 of them have been sent out, and the demand for them is greater than the supply. Any of our readers interested in a pretty ornament will find this hanger worth sending for.

A meeting of English railway trainmen was held lately to agitate in favor of obtaining shorter hours and better pay from their employers. It was decided that 150 miles be equivalent to a day for express passenger trains. An express train was declared to be one having a connection cord between the cars and running 20 miles without stopping. A resolution was adopted holding that 100 miles should be a day's work on a local passenger train and through freight trains.

The well-known oil supply house of Leonard & Ellis, who have long occupied the entire building at 157 Chambers street, have taken larger and better offices in the new Bowling Green building at 11 Broadway, New York. Many years ago these people started out to make and keep a reputation for their "Valvoline" oils, and that they have done so is proven by the fact that their business has grown year by year, until they have outgrown their old quarters.

The Boston Belting Company have recently issued a little booklet on rubber goods. It contains a great deal of interesting information about the production and manufacture of rubber, and will be found quite interesting reading. Persons interested in this line of goods can obtain a copy of the little book on application to Mr. James Bennett Forsyth, Boston, Mass., who holds the copyright of the book.

The Sargent Company, Chicago, report the largest month's business ever done with the Sargent and Ross-Mehan brake shoes. Several railroad companies have recently adopted the Sargent shoe as the standard, while all the old customers are ordering more freely than at any previous time. They are also very busy in the open-hearth and crucible furnace department.

One of the curiosities of legislation is a bill that has been introduced in the Missouri Legislature to punish railroad conductors and brakemen for flirting with lady passengers. The punishment to be accorded to this crime is a fine of $25.

The Ohio river at Cincinnati reached the stage of 61 feet and 4 inches, and blocked all the railway lines, except one, and this one was the C., H. & D. Ry. It is known as the "High and Dry" line.

The Canadian Pacific are reported to have made arrangements for running trains between Hamilton and Buffalo over the Toronto, Hamilton & Buffalo Railway.

The Davis & Egan Machine Tool Company, Cincinnati, have opened a branch office with Cleveland Tool Supply Company, Cleveland, O.

Buyers' Finding List.

AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll Sergeant Drill Co., N. Y. City
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co., Philadelphia, Pa.
Rand Drill Co., New York.

AIR DRILLING MACHINE.
C. H. Haeseler & Co., Philadelphia, Pa.

AIR LOCOMOTIVES.
Baldwin Locomotive Works Philadelphia Pa.

AIR PUMP GOVERNORS.
Mason Regulator Co., Boston, Mass.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS
Carey Mfg. Co., Philip. Lockland, O.
H. W. Johns Mfg. Co., New York.

AXLES.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

BALANCED SLIDE VALVES.
Am. Bal. Slide Valve Co., San Francisco, Cal.
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER CHECKS—INSIDE.
Foster Engineering Co., Newark, N. J.

BOILER COVERINGS.
Carey Mfg. Co., Philip, Lockland, O.

BOILERS.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

BOILER TOOLS.
Richard Dudgeon, New York.

BOILER TUBES, LOCOMOTIVE.
Allison Mfg. Co., Philadelphia, Pa.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.
Manning, Maxwell & Moore, New York
National Machinery Co., Tiffin, O.

BOOKS.
Audel & Co., New York.
H. C. Baird & Co., Philadelphia, Pa.
Philadelphia Book Co., Philadelphia, Pa.

BORING MILLS.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
Ramapo Wheel & Foundry Co., Ramapo, N. Y.
The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
S. J. Meeker, Newark, N. J.
Paul S. Reeves, Philadelphia, Pa.

BUFFERS, BLOCKS, SPRING.
Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
Williams, White & Co., Moline, Ill.

CARS.
J. G. Brill Co., Philadelphia, Pa.
Lima Locomotive & Machine Co., Lima, O.
Ramapo Iron Works, Hillburn, N. Y.

CAR COUPLERS.
Gould Coupler Co., Buffalo, N. Y.
Latrobe Steel Co., Philadelphia, Pa.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
Sams Automatic Coupler Co., Denver, Col.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

CAR DOOR FASTENERS.
National Malleable Castings Co., Chicago, Ill.

(Continued on page 324.)

BUYERS' FINDING LIST—*Continued.*

CAR FORGINGS.
Dickson Mfg. Co., Scranton, Pa.

CARS, FREIGHT.
Allison Mfg. Co., Philadelphia, Pa.

CAR HEATING.
William C. Baker, New York.
Safety Car Heating & Lighting Co., New York

CAR HEATING HOSE.
N. Y. Belting & Packing Co., New York.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR ROOFING.
Standard Paint Co., New York.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.

CAR WHEELS.
Krupp (T. Prosser & Son, New York).
Ramapo Wheel & Foundry Co., Ramapo, N.Y
Standard Steel Works, Philadelphia, Pa.

CAR WHEEL BORERS.
Manning, Maxwell & Moore, New York.

CASTINGS, STEEL.
Lima Locomotive & Machine Co., Lima, O.
Sargeant Co., Chicago, Ill.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHANNELERS.
Ingersoll Sergeant Drill Co., New York.

CHIME WHISTLES.
Star Brass Mfg. Co., Boston, Mass.

COAL HANDLING MACHINERY.
Link Belt Engineering Co., Philadelphia, Pa.
The Pratt & Whitney Co., Hartford, Conn.

COAL CHUTES.
Williams, White & Co., Moline, Ill.

CONVEYORS.
Link Belt Engineering Co., Philadelphia, Pa.

CORRESPONDENCE SCHOOLS.
Internat'l Corres. Schools, Scranton, Pa.

CUTTING-OFF MACHINES, COLD SAW.
Newton Mach Tool Works, Philadelphia, Pa.

CRANES.
Manning, Maxwell & Moore, New York.
Maris Bros., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANES, TRAVELING SWING.
Wm. Sellers & Co., Philadelphia, Pa.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.
Krupp (T. Prosser & Son, New York).

CYLINDER BORING AND FACING MACHINES.
Pedrick & Ayer Co., Philadelphia, Pa.

DRILLS
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O
The Pratt & Whitney Co., Hartford, Conn.

DUPLEX AIR GAGES.
Star Brass Mfg. Co., Boston, Mass.

ELECTRIC LIGHTING AND POWER APPARATUS.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa

ELECTRIC LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

FILES AND RASPS.
Nicholson File Co., Providence, R. I.

FLEXIBLE SHAFT.
Stow Flexible Shaft Co., Philadelphia, Pa.

FLEXIBLE STEAM JOINT.
Moran Flexible Steam Joint Co., Louisville, Ky.

FORGES.
The Bradley Co., Syracuse, N. Y.

FORGING MACHINERY.
Acme Machinery Co., Cleveland, O.
Williams, White & Co., Moline, Ill.

FORGINGS, HEAVY.
Brooks Locomotive Works, Dunkirk, N. Y.
Richmond Loco. & Mch. Wks., Richmond, Va.

FROGS AND CROSSINGS.
Ramapo Iron Works, Hillburn, N. Y.

GEAR CUTTERS.
Gould & Eberhardt, Newark, N. J.

GRAPHITE.
Jos Dixon Crucible Co., Jersey City, N. J.

GREY IRON.
S. J. Meeker, Newark, N. J.

(Continued on page 325.)

BUYERS' FINDING LIST *Continued.*

HAMMERS, POWER.
Bradley Co., The Syracuse, N. Y.

HEATING SYSTEM, FAN.
Buffalo Forge Co.

HOISTS, PNEUMATIC.
Pedrick & Ayer Co., Philadelphia, Pa.

HOLLOW STAYBOLT IRON.
Falls Hollow Staybolt Co., Cuyahoga Falls, O.

HYDRAULIC JACKS.
The Watson-Stillman Co., New York

HYDRAULIC TOOLS.
R. D. Wood & Co., Philadelphia, Pa

INJECTORS.
Nathan Mfg. Co., New York.

INJECTORS, LOCOMOTIVE.
Wm Sellers & Co., Philadelphia Pa.

JACKS.
E. C. Boyer, Dayton, O
Richard Dudgeon, New York.
Watson & Stillman, New York

JACK SCREWS.
Chapman Jack Co., Cleveland, O

JEWELRY.
S. N. Clarkson & Co., Chicago, Ill

JOURNAL BOXES AND LIDS.
National Malleable Castings Co., Chicago, Ill

LAGGINGS FOR LOCOMOTIVES.
Carey Mfg. Co., Philip, Lockland, O.
H. W. Johns Mfg. Co., New York.

LATHES.
Bement, Miles & Co., Philadelphia, Pa
W. D. Forbes & Co., Hoboken, N. J.
Jones & Lamson Machine Co., Springfield, Vt.
Manning, Maxwell & Moore, New York
Niles Tool Works Co., Hamilton, O
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

LOCOMOTIVE, LOGGING.
Brooks Locomotive Works, Dunkirk, N. Y.

LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Loco & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton Pa.
Lima Locomotive & Machine Co., Lima, O.
Pittsburg Locomotive Works, Pittsburg, Pa.
H. K. Porter & Co., Pittsburg, Pa.
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Nathan Mfg. Co., New York.

(*Continued on page 3..*)

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(*Continued on page 327.*)

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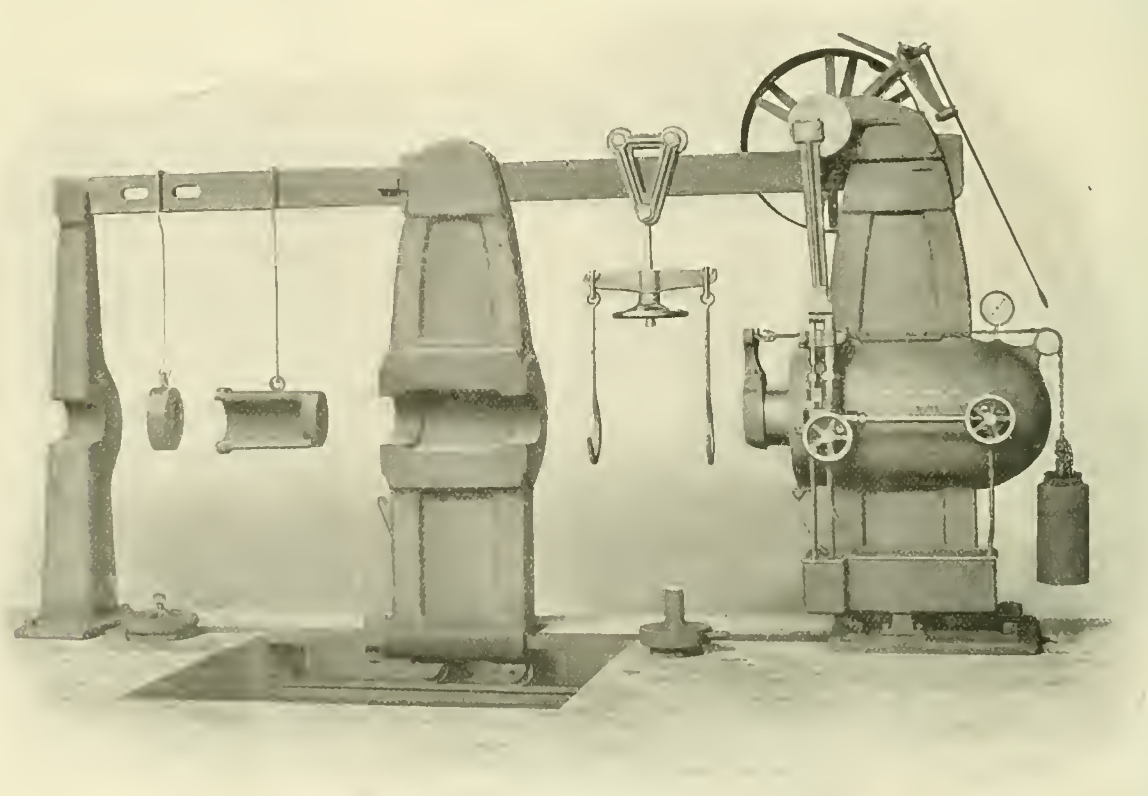

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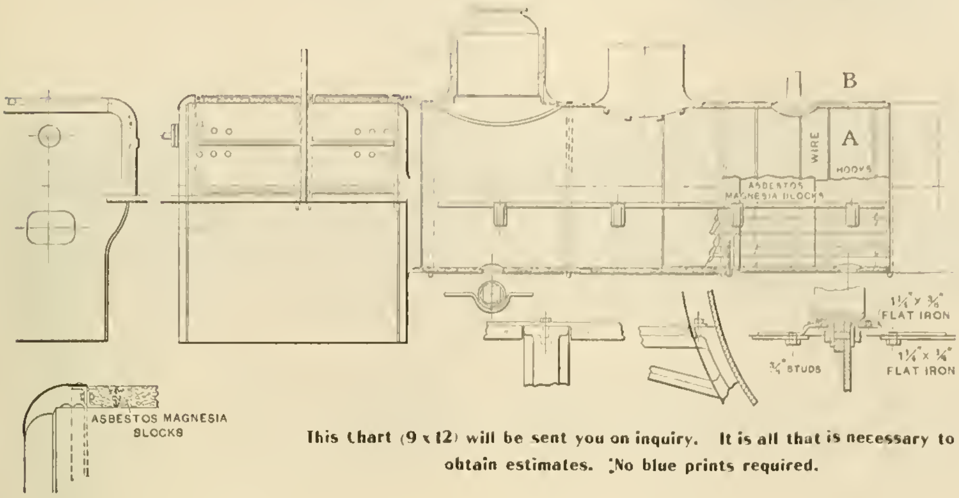

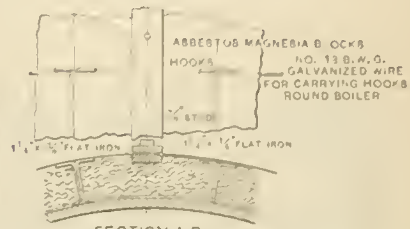

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30	6" x 32½" x 2"	29	On Front Sheet Barrel
55	6" x 26⅛" x 1¾"	29	" Intermediate "
52	6" x 27" x 1⅝"	29	" Back Sheet " "
9	3" x 31½" x 2"	Flat	" Fire Box Outs of Cab Top
9	3" x 38" x 2"	"	" " " Ins " " "
10	2⅝" x 34½" x 2"	8	" " " Outs " " Corners
10	2⅝" x 38" x 2"	"	" " " Ins " " "
5	6" x 34½" x 2"	Flat	" " " Outs " " Sides
5	6" x 38" x 2"	"	" " " Ins " " "
36	2⅝" x 30" x 1½"	15	" Dome

Any block can be removed without disturbing the others.

The best improved Laggings at interesting prices.

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No. of Blocks Required	Dimensions of Block	Radius	Remarks

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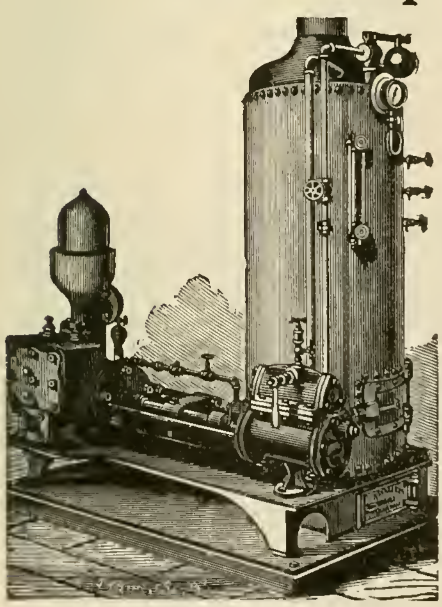

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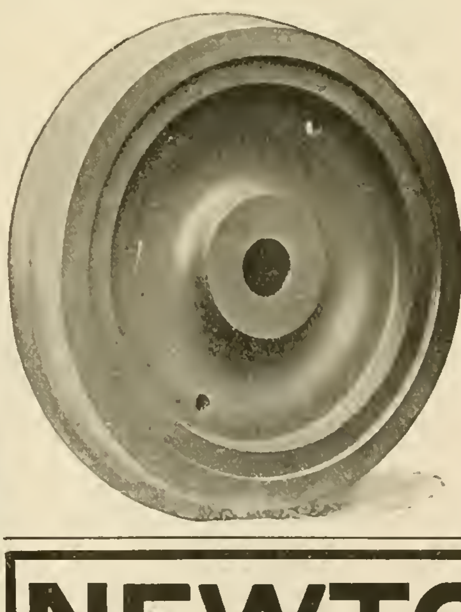

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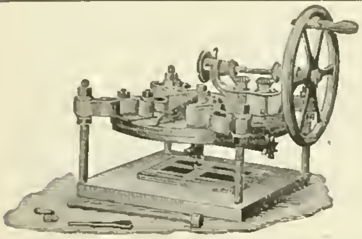

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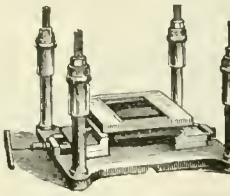

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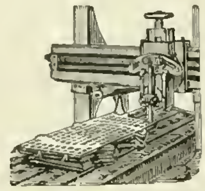

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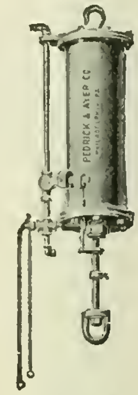

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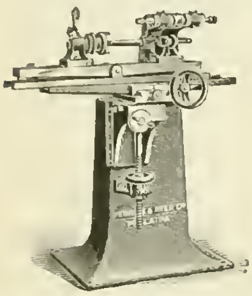

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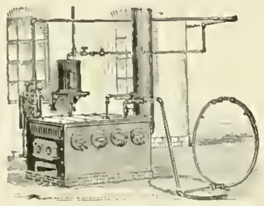

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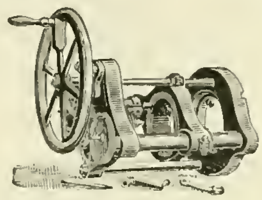

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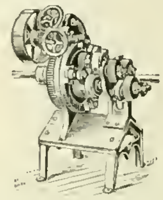

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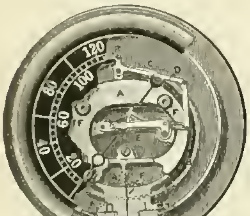

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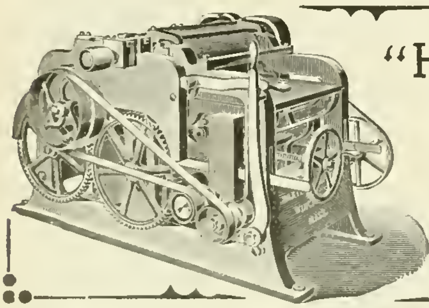

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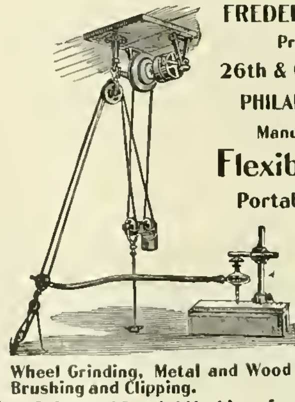

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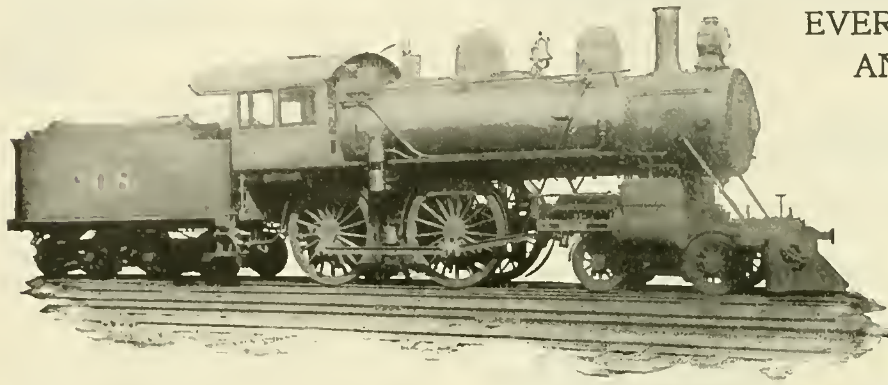

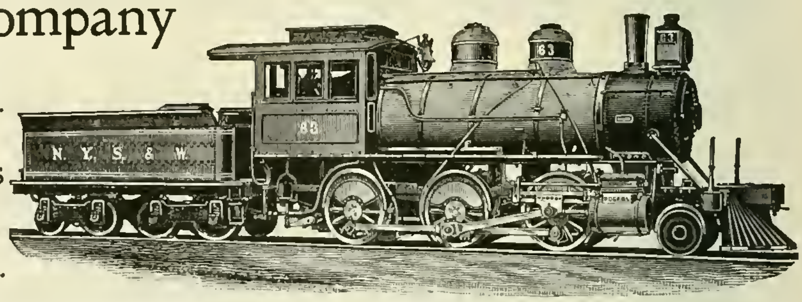
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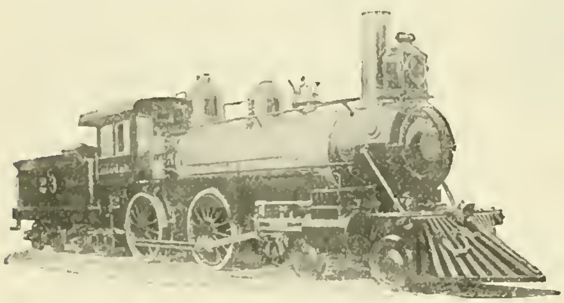

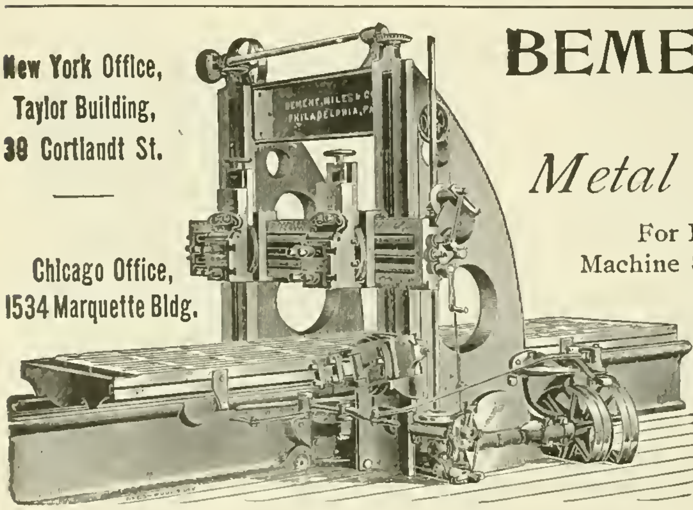

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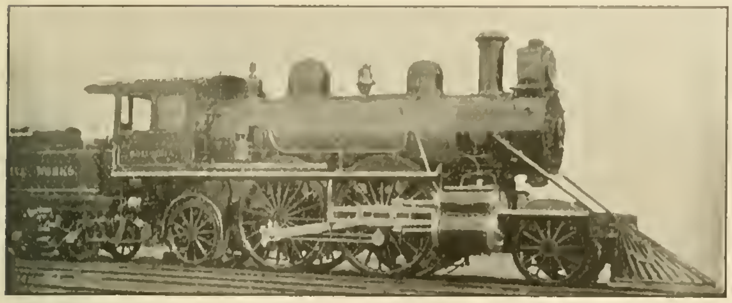

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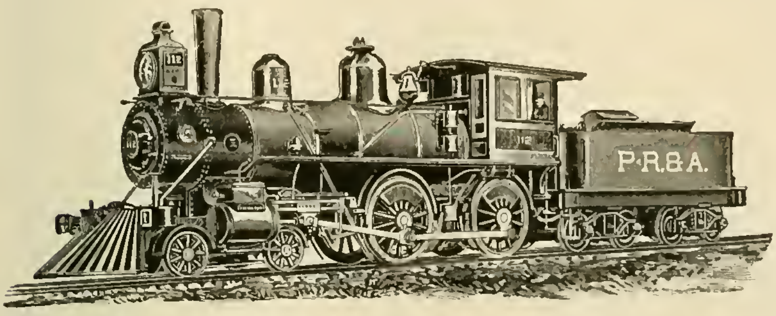

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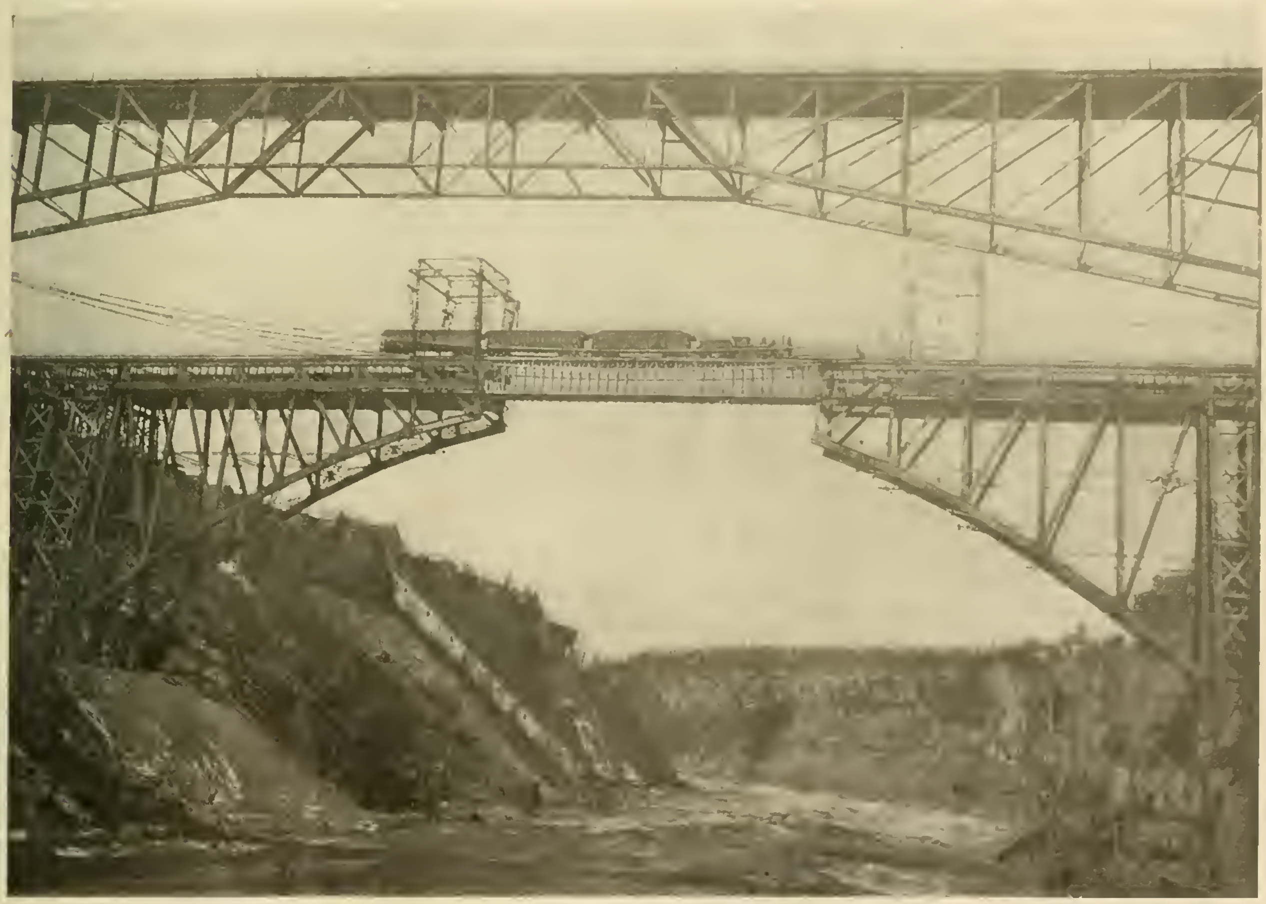
Vol. X. NEW YORK, MAY, 1897. No. 5.

New Bridge Over Niagara River.

BY ORRIN E. DUNLAP.

The new steel arch bridge that is being built across the Niagara gorge by the Niagara Falls International Bridge Company and the Niagara Falls Suspension Bridge Company, one a Canadian and the other a New York State incorporation, is expected to be finished some time has been lost, while the erection of the bridge is looked upon as one of the great engineering feats of the century.

Preparatory to the erection of the steel superstructure, substantial abutments of masonry were built on both sides of the river. These abutments are four in number, two on each side, and are located midway between the water's edge and the and from them extends the first section or panels of the new arch. Before the placing of steel commenced, huge structures of false work were built between the abutments and the top of the cliffs, and on these the end spans were erected. Beyond the line of the abutments the two arms of the arch were built out from each side, panel after panel, as is made clear



NEW GRAND TRUNK BRIDGE OVER NIAGARA RIVER.

in July. This new arch is the first structure of its kind to span the Niagara, and it is being built to replace the railway suspension bridge in order to afford increased facilities to accommodate the Grand Trunk's constantly increasing traffic between the West and the East. The work of erecting the bridge has been in progress all winter, and despite the dangerous nature of the task, not a single life top of the high bank. On the Canadian side it was found necessary to build a concrete foundation, but on the New York State bank they rest on the stratum of Clinton limestone. The stone for the Canadian abutments was obtained in Queenston, Ont., while that for the New York abutments came from Chaumont, Jefferson County. Upon each abutment a great steel shoe or bed-plate is placed, in plate No. 1, until they met in the center, high over midstream, all the time held back by a clever system of anchors deeply imbedded in the solid rock of the cliff, from which position many times the weight of the arms of the arch would not pull them. The illustrations clearly show the huge traveling derricks used to deposit the panels in place. The last panel of the arch was placed in position on Sunday, March 28th, and on the day following the two sections of the arch were joined by releasing screws at either end of the structure and allowing the two sections to settle until the 2-inch space which remained after the last panel was placed to close up. This adjustment of the two sections was done with such nicety that the bolt holes in the plates of the two sections met perfectly, and was the climax of the work of months, which told of the extreme accuracy of all members of the arch.

The main span of the arch is 550 feet between centers of end pins, and is connected to the top of the bank on each side of the river by a trussed span 115 feet long. In addition there are plate girder approaches at each end 145 feet long, which makes the total length of the new bridge 1,070 feet. The rise of the arch is about 114 feet, and from the water to the top floor of the arch will be about 240 feet. The arch will have two floors or decks. The upper floor will be devoted to tracks for the steam railroads, while the lower floor will be divided into carriageways, sidewalks, and through the center will run a single track for trolley cars. The upper floor will be double tracked, with walks to allow of customs inspectors examining trains. The suspension bridge is but 18½ feet wide, while the arch will have a width of 47½ feet on the lower floor. As the primary object in constructing the new arch is to secure increased facilities for crossing the Niagara chasm, the arch is naturally designed to carry a very heavy load. In fact, the demand is that the bridge shall carry 7,000 pounds live load to the running foot on the upper deck and 3,000 on the lower deck, or 10,000 lbs. live load in all, which is indeed an enormous load.

The chief engineer of the work and the designer of the arch is Mr. L. L. Buck, whose eminent standing as an engineer and bridge builder is known to the world. The Pennsylvania Steel Company, of Steelton, Pa., have the contract. It will be seen by the illustrations that the arch is being built under and about the suspension bridge without any interruption to traffic thereon. To build an arch of such proportions is of itself a task of no small magnitude, but to erect it on the very site of an existing bridge increases the difficulties many fold.

NEW BRIDGE OVER NIAGARA RIVER.

⁂

Owing to a panic, caused by the plague which is raging in Bombay, India, one day in January no less than 1,500 of the men employed in the locomotive work shops of the Great India Peninsula Railway failed to go to work. The railway authorities have done their best to keep the men at work, and one of the measures adopted was to sell grain to the workmen at reasonable terms. The strike was settled in a very few days.

From Turin to Zurich.

[EDITORIAL CORRESPONDENCE.]

None of my ramblings in Italy interested me more than the trip from Turin to Milan, although the route did not present the scenic attractions that are to be found in most other parts. The railroad traverses what we would call a prairie country, since it is flat and fertile, but it is not the kind of prairie one finds in Illinois and Iowa. The soil may be no less rich, but man's labor has made it a continuous garden.

Although the country through which the railway passes is flat, the mountains are always in sight, and the train is constantly crossing streams that come from the melting snows on the Alps. This water is largely utilized for irrigation purposes, and most of the farmers in Piedmont and Lombardy are independent of rain fall.

I have heard the remark made about the American rural ambition to own big tracts of land; that a man may prosper on 40 acres and bust on a quarter section. The people in Northern Italy appear to understand the advantage of thoroughly cultivating little patches, and all that skill and industry can achieve is worked out to make the land produce its most bounteous returns.

FIELD LABOR.

The express train does not rush along in any particular hurry, and there is no difficulty in crowding my note-book with reminders that may be useful. A thing that has always galled me while traveling in Europe has been the sight of women working in the fields doing the hard drudgery of oppressive labor, bearing the heat and burden of the day. To a humane man this looks as unwomanly work, and the natural impulse is to denounce it. But under present dispensations, many women must help to earn their own or the household bread, and when comparisons are made, the Lombard field worker may not be in so much of a pitiable condition as the New York factory operatives.

Since I returned home I was discussing this subject with a friend who has a great horror of the unwomanly ways of "sweat shops," and he offered to initiate me into the mysteries of these soul grinding establishments. After a little insight into these the impression came that free America leaves little cause for stone-throwing at the oppressed condition of labor in other countries, when a full-grown woman is paid as a recompense of hard labor fifty cents a day, earned in stifling rooms that inject physical and moral poison into the victim. Coarse food, rough labor and exposure to climate, the fate of many European women, have their compensations in pure air and healthy occupations.

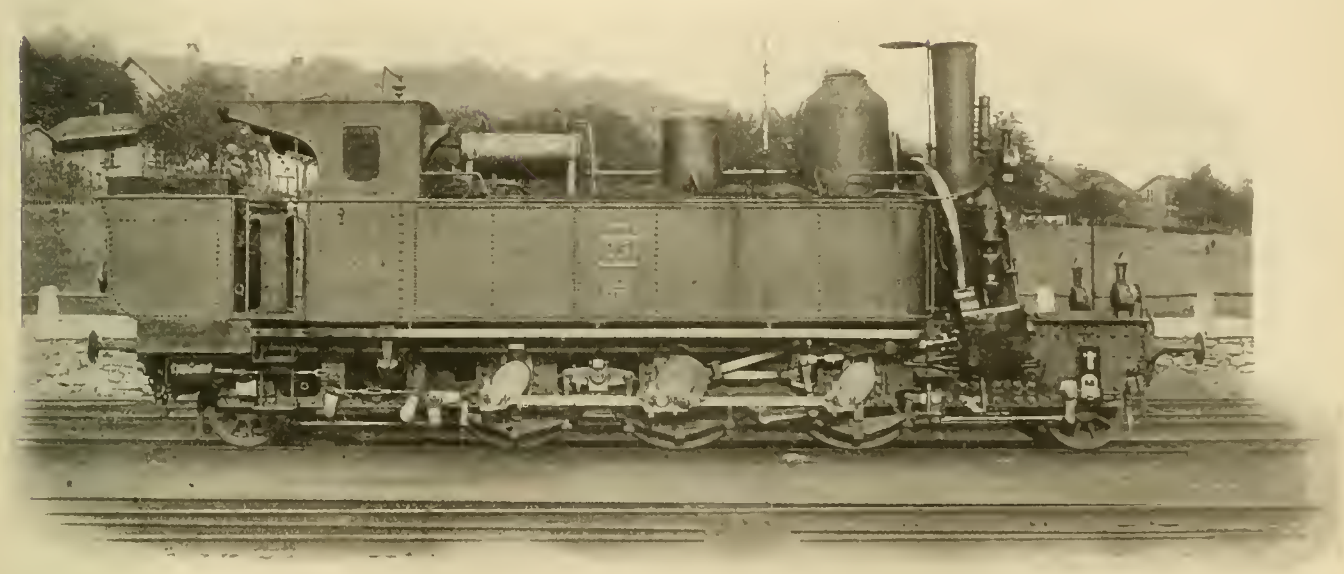
UNFENCED RAILWAYS.

After evaporating my indignation on the system which bound these buxom, red-cheeked damsels, with their raven hair, dusky looks and coquettish touches of color, wielding the prosaic hoe, I got wondering why the railroads were not fenced. This is a peculiarity of Italian railways that I had noticed before. I asked the fellow-travelers in the carriage why it was not necessary for the railway companies to put up fences, and they did not seem to understand anything about it. I afterwards learned that the railway companies in Italy are not required to put up fences. In that regard, railways are treated the same as any other property. They hold that no man's ox, nor his ass, nor his goat, nor any other agricultural product, has any more right to stray upon the railway right of way than it has to walk into a private person's garden and eat up his onions, garlic, cabbages and cucumbers. The assumption of Italian law is that the owner of flocks and herds is responsible for keeping them off other people's pastures, and railroad right of way is not discriminated against any more than any other kind of property.

The idea struck me as a novel one, but it is founded on a basis of eternal justice, which was the glory of the old Roman law. Why should a railroad company have to fence its property against the encroachment of steers and swine, when a private citizen's lawn is protected by the right of collection for damages done by intruding animals? The idea of railroad companies being treated differently from other forms of land property is carried to excess in America. In our worship of liberty, we are constantly climbing over the fence of justice. Just think what a howl it would create in the grazing States if the United States Supreme Court decided that any law, making a railroad company liable for damages for stock that had been killed when trespassing upon its right of way, was unconstitutional. Yet, looking at the case from the standpoint of abstract justice, a decision of the kind would be nothing more than fair. If a private individual, even in America, where subversive ideas concerning the rights of property are peculiarly rampant, bought a strip of 100 feet wide through a series of farms for 100 miles, and devoted the ground to the cultivation of cabbages and other garden truck, no one would question his right to collect damages from the intruder who permitted his hogs to feed upon his products. Where then is the justice of treating differently one who put down steel rails to run cars upon?

MILAN CATHEDRAL.

The city of Milan does not possess many railroad attractions, but it has others that can never be seen and forgotten. The principal one is the Cathedral. This building is considered by many Italians as the eighth wonder of the world, and it deserves the admiration thus implied. The building is of white marble, and the turrets and spires on its roof are so numerous that they remind me of stalks of wheat, only they excel nature in beauty of form. The statues used in the adornment of the building seem innumerable. It covers 17,000 square yards, is capable of accommodating 40,000 people, and its highest tower is 360 feet above the pavement.



SWISS MOUNTAIN CLIMBER.

As you wander round and gaze upon the building, it seems to grow in magnitude and grace every hour. As long as you remain within view of its gigantic form, softened by the symmetry of every turret, spire and statue, you find your eyes constantly turning towards it for one more look. I never saw anything before that fascinated me so much except Mount Tacoma, under the sheen of a setting sun.

THE LAST SUPPER.

When I was a boy every house of any genteel pretensions had a picture of the "Last Supper." They were steel engravings, real works of art, and from looking at those pictures I first formed an idea of how artists could portray human emotions. In after years I came to know that the pictures were representations of a painting by Leonardo da Vinci, a famous Italian painter. The knowledge also came that the original painting was in Milan, and I made up my mind to see it.

I thought that everybody in Milan would know all about where da Vinci's masterpiece was to be seen, but I was sent to two picture galleries on a wild-goose chase, and afterwards, through an intelligent cabman, found out that it was in an old church called Maria Delle Grazie. The picture covers the end wall of a chapel and is in a very dilapidated condition. It was painted in oil on that wall about the time America was discovered, so there is good excuse for its being in a scaly condition. In fact, so many scales of the painting have fallen off, that it is difficult to identify the figures. There were several art students copying the painting, and I consider their work was much superior to da Vinci's, but then they had the advantage of freshness. The picture is reputed to represent the emotions depicted on the face of the disciples when Christ intimated that one of them would betray him. There is nothing left now but vague blurs of faces.

THE VERY EARLIEST KIND OF RAILWAY.

From what the railway men in Turin had told me, I expected to find nothing in the railway line of interest in Milan, yet I discovered in the streets of that city tracks that were invented before this era began, and probably first gave the suggestions that ultimately led to the perfected track of to-day.

The whole of the civilized world was once ruled by a nation that had headquarters in Rome. The rule of Rome was of the aggressive kind, and the sagacious rulers found out that rapid means of intercommunication was necessary to keep the strong hand of the central power ever within striking distance of the remotest province.

As that was before the days of Bessemer steel, or even puddled iron, the engineers of the period took the material within their reach and built roads, having a double line of long stone blocks on which the wheels of chariots ran with nearly as little frictional resistance as a railroad car encounters on a rough track. These roads were pushed into every region where Rome held sway, and remains of them are to be seen to this day in far away Scotland.

In all the older portions of Milan and in the newer parts, too, where there are no street car lines, these stone block tramways are general, and they are carefully followed by wagons and carriages. I judge, from a careful examination of these stone tramways, that the original gage of wheeled vehicles was five feet. This is new evidence proving that the engineers who narrowed up the gage 3½ inches blundered.

GLORIES OF MILAN.

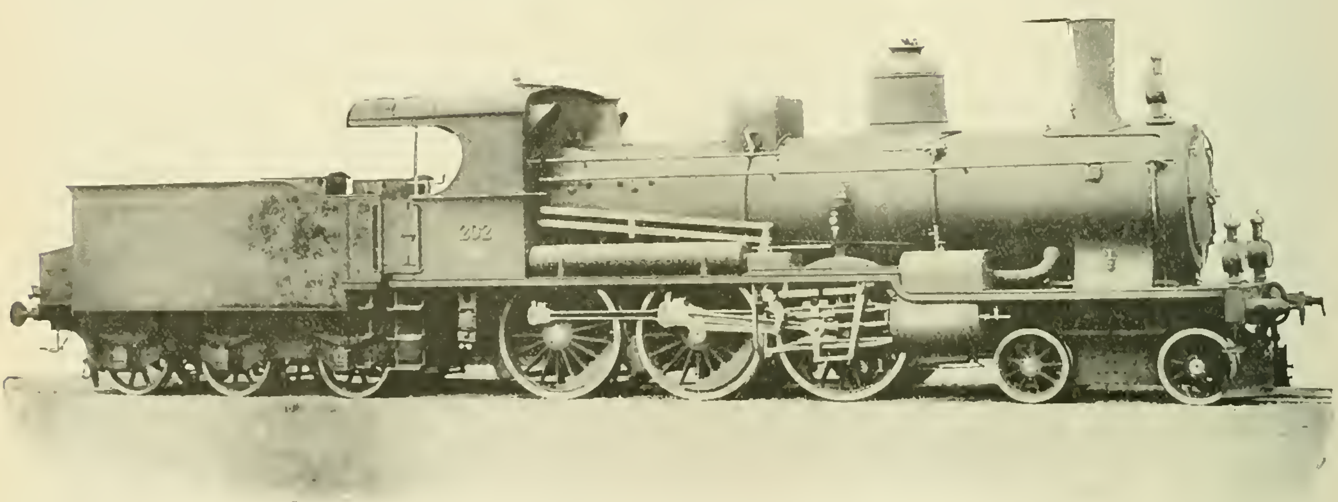
I wish I could fill two or three pages about the attractions of Milan, but the lack of railroad themes connected with the place forces me to spare the readers of "Locomotive Engineering." It is a great manufacturing city, about as large as St. Louis, and, as far as I could learn, turns out more art work than any other city in the world. Its specialties are sculpture and painting, but it also produces a vast amount of silks, art furniture and other articles, mostly of an artistic character.

Its principal glory, however, seems to be churches. They are to be found in every street; handsome edifices, many of them famous for what has happened within their walls. All of them are elaborately decorated with noble frescoes, beautiful carving and impressive embellished windows that have an awe-inspiring effect. I looked into several of the churches on Sunday forenoon, and was rather unfavorably impressed with the service and the attitude of the worshippers. The impression made was, that awe-inspiring structures and surroundings had not much influence in exciting religious emotions.

From Milan I went to Como, a small town at the end of a most beautiful lake of the same name. I remembered that Volta, the electrician, was born there, and considered that as an excuse for stopping off. Besides, all my friends had urged me to see the lake. European cities are mostly famous for events connected with warriors or ecclesiastics, conspicuous ruffians or artists, and so I was glad to pay homage, in my small way, to a devotee of science.

BATHED IN GARLIC.

When I got seated in the carriage at the station in Milan, I found the company to be exceedingly sociable and friendly—a condition of affairs that does not very often meet travelers in Europe. Almost as soon as we had started, one of the company asked me if I objected to smoking, and I answered that I did not. Then he took out a cigarette, and all the others did the same. If there is anything I abhor more than the smell of Limburger cheese, it is cigarette smoke, and the government of Italy having a monopoly in the manufacture of tobacco products, the smell of the Italian cigarette is naturally the rankest to be found anywhere. However, I stood it with great fortitude, and the other members of the compartment paid me marked attention. One, in particular, was anxious to know where I was going, and told me a great many interesting facts about the villages, chateaus and castles to be seen as we went along. Then he informed me that he was going to stop at Como also, and it would give him infinite pleasure to show me the way to the most comfortable hotel in the town. As I did not then know anything about the hotels, and had been imposed upon several times by the guide-book, I agreed to go with him. When we got off, we took a cab to a hotel, which he named,



ST. GOTTHARD RAILWAY LOCOMOTIVE.

and then he intimated his willingness to be my guest at dinner. The food that was brought us was so much sur-charged with garlic, and the air of the hotel was so heavy with the same odor, that it cost me three Turkish baths on my way to Scotland before I was entirely rid of the garlic bath which I carried away with me.

The town, which is older than our era, seems to be noted principally for its churches. My acquaintance wanted me to visit two or three dozen of the most noted ones, but I had become satiated with churches, and wanted to look at the house where Volta was born. Nobody knew anything about it, so I went and lingered within sight of the famous lake. To tell the truth, it was a disappointment, and did not begin to compare in scenic attractions with Lake George or Loch Lomond. To be sure, its precipitous banks are picturesque, with their white villas, profuse woods and terraced vineyards; but I had seen many other places where I should prefer to take up a permanent residence. The lake does not look wider than the Hudson, fills a tortuous fissure among mountains, and is over-estimated. I heard Americans raving about its beauties, who evidently never looked upon the Highlands of the Hudson with unbandaged eyes.

OVER THE ST. GOTTHARD RAILWAY.

Italy is a most attractive country for people interested in art and churches and ruins, but I was not sorry when I mounted a train bound for Zurich, in Switzerland. The train was a first-class continental express, and had eighteen vestibule cars, each about the length of our box cars. The trip from Como to Zurich is about 120 miles, and displays in its course the most stupendous feats of engineering to be found in that length of any railway in the world. It is the St. Gotthard Railway, so named on account of the famous tunnel of that name which pierces the Alps at the summit of the route. The trip occupied about nine hours, or a little under 14 miles an hour, which cannot be regarded as wild speed, even on an Alpine railway; but I never made a journey, since my first trip through part of the Highlands of Scotland, which I enjoyed so much. Every yard of the way outside of the tunnels revealed to the eye varying panoramas that vied with each other in displaying surpassing scenes of beauty, magnificence and grandeur.

The slow pace did not seem due to inert motive power, for the locomotives hauling the train were the most powerful I had seen in Europe. Two of them are shown, taken from Camille Barbey's book on Swiss locomotives.

ANCIENT AND MODERN ROBBERS.

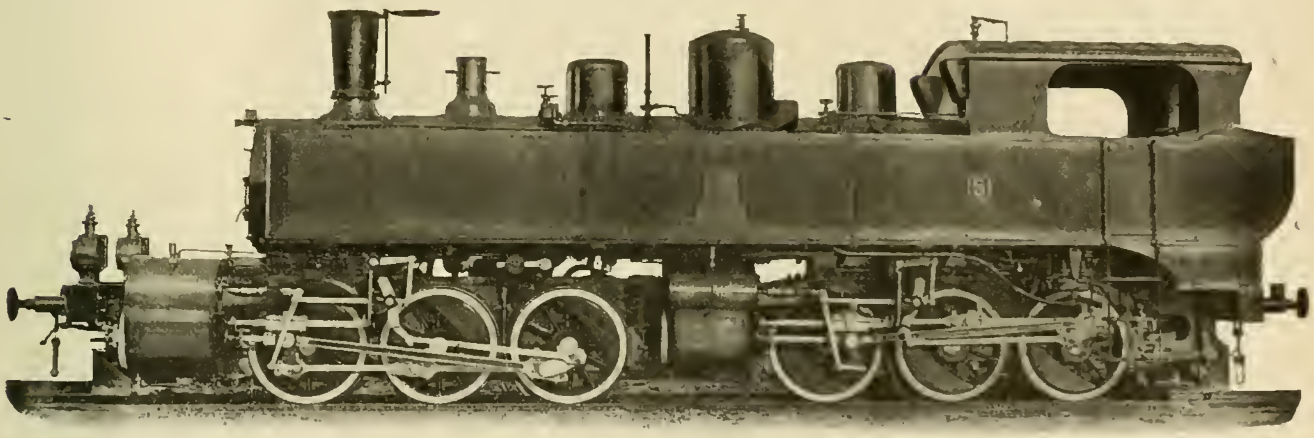
The mountains on this route seem more savage and forbidding than those along the Mount Cenis route, but the enterprising immigrants from the north must have found convenient means of crossing, if we are to judge by the numerous ruins of fortresses and turreted castles that had been erected to keep the sacred soil of Italy free from these unwelcome visitors. We seem to find these ancient structures of defence every mile, and very picturesque they look now in their ivied desolation.

Things are radically changed in Italy since these hoary works of masonry were erected. Then the people were struggling to keep the strangers from their gates, because they knew that the strangers were skillful and enterprising robbers. In this last half century the Italian government have spent two or three hundred millions of dollars to make the way of the stranger's visit easy. The Italians, under the new order of things, do the robbing, and I have no doubt that the enterprise of the government has brought good returns. It is not my habit to complain when I have been cheated, but I was victimized in Italy in every town. They have a depreciated currency which is worth about 85 per cent. of its value in gold. The money I carried was gold, and every purchase was changed at currency value and change given on the same basis. I argued with several of the robbers, but they always ceased to understand my French whenever a diversity of opinion on money matters arose. I have until this moment kept it from my most intimate friends, but I now confess that I was more outrageously cheated in Italy than in any other country I ever was in. I once felt indignant in Colorado, in the Leadville excitement times, because they charged me 50 cents for a glass of milk and a piece of pie, but I had not visited Italy at that time or I should have looked upon it as a moderate charge.

THROUGH A CHAIN OF TUNNELS.

When a man catering to the tastes of readers sees anything which gives him unusual pleasure, he naturally wishes to transmit the pleasures to his constituents. I have never felt so helpless in performing this pleasing duty as I have been about my ride over the St. Gotthard Railway. Word painting is tame beside the sight witnessed. For a long way in its assault of the mountains the railway followed the bank of a valley that seemed a dry extension of the fissure that holds the waters of Lake Como. The valley is greener than Ireland, is studded with towns and villages and prosperous-looking farms, with fine roads, and groves and orchards and vineyards without number. The cosy red-roofed cottages buried in flowers and shrubbery, the quaint looking ivy-covered inns, left impressions not readily forgotten. Owing to its diversity of coloring, it really seemed more beautiful than the valleys of Virginia, and that is saying a great deal for an admirer of America, with no sectional prejudice.

When we drew away from the fringe of this valley, we came into districts that must have burdened the lives of the railway builders. In about seventy miles I counted forty-four tunnels; but the guide-book says there are fifty-six in the district named. As usual in climbing into the heart of a great mountain, the railway followed the excavations made by a river. That followed to St. Gotthard, is about the most foaming and fuming and tumultuous cascade-forming stream that I have ever looked upon. We crossed



ST. GOTTHARD HILL CLIMBER—MALLET COMPOUND.

and recrossed it times without number, hugged its precipitous banks, that originally left no pathway for a goat, and eluded its bends by diving through dark tunnels and rock cuttings whose sides seemed to meet in the skies. In the route through the mountains there are said to be fifty-six bridges and ten viaducts. Before we reached the great tunnel we went through four which formed a spiral in the ascent, and there were three of a similar character on the other side.

The St. Gotthard tunnel is 9¼ miles long, 28 feet wide and 21 feet high, and forms a sort of double spiral under the mountain. With the cheap labor employed and the use of the mountain streams to compress the air used in boring, it cost about $12,000,000. The approaches on each side must have cost ten times as much.

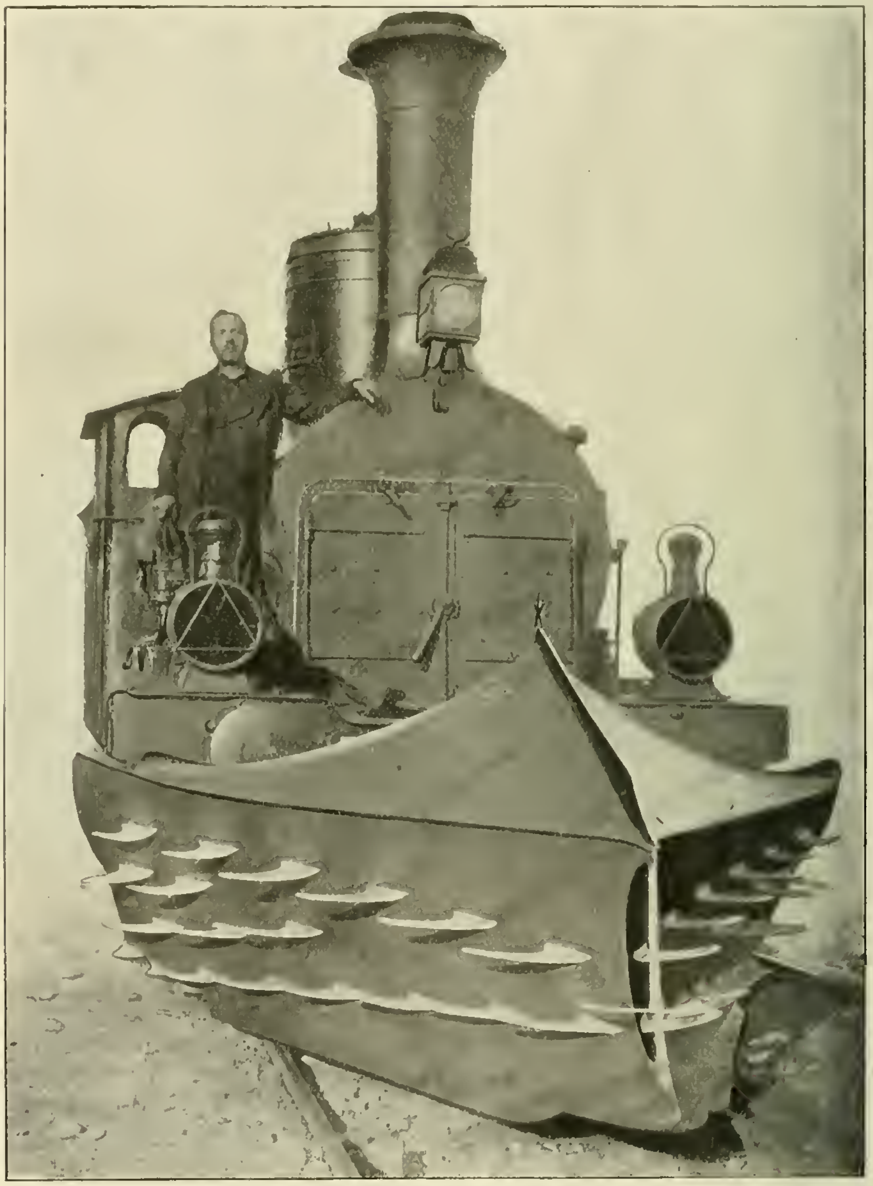
The Italian Government did not bear all the expense of constructing this stupendous undertaking. Switzerland and Germany bore a good share of it; but I cannot imagine how they got their money back. From my experience in the countries interested, I think the risks were greater than that of putting good money into the stock of a Granger operated railroad. A. S.

Failures with Early Locomotives.

Our historical charts, showing the development of the locomotive, show many curious machines, but they were all practical locomotives, that could run and haul trains according to their capacity as well as the modern locomotive. At the time some of the early engines were got out, there were others that were failures and have retained no place in the history of the locomotive.

Before builders made locomotive building a specialty, the owners of nearly every foundry and machine shop in the country considered they could build a successful locomotive, and a great many ingenious men, who were not mechanics at all, tried their hand at inventing locomotives. Some very curious machines came forth in this way.

Among the early designers of locomotives was Col. T. H. Long, a famous civil engineer, who was connected with the Baltimore & Ohio. He designed a locomotive and had it built, but it never did any train hauling. In the course of a speech delivered years afterward, Col. Long talked about his experience as a locomotive builder, and said that during the trial trip, they were seven hours and a quarter in going four miles, and they were going all the time. Col. Long's experience was not unlike evidence given by Napier, a famous Scotch civil engineer, after the trial of one of the pioneer locomotives experimented with in Scotland. All sorts of odd engines were tried there, and the builder of this particular engine asked Napier to go and see the trial. The builder wanted to get some capitalists interested in his invention, and tried to get Napier to express a favorable opinion of the machine, but he could get nothing but grunts out of the engineer. Then the man exclaimed, impatiently, "You saw the engine running, at any rate!" "Well," said Napier, "you may call it running. The only running I saw was you fellows shoving the engine."



ITALIAN SNOW PLOW.

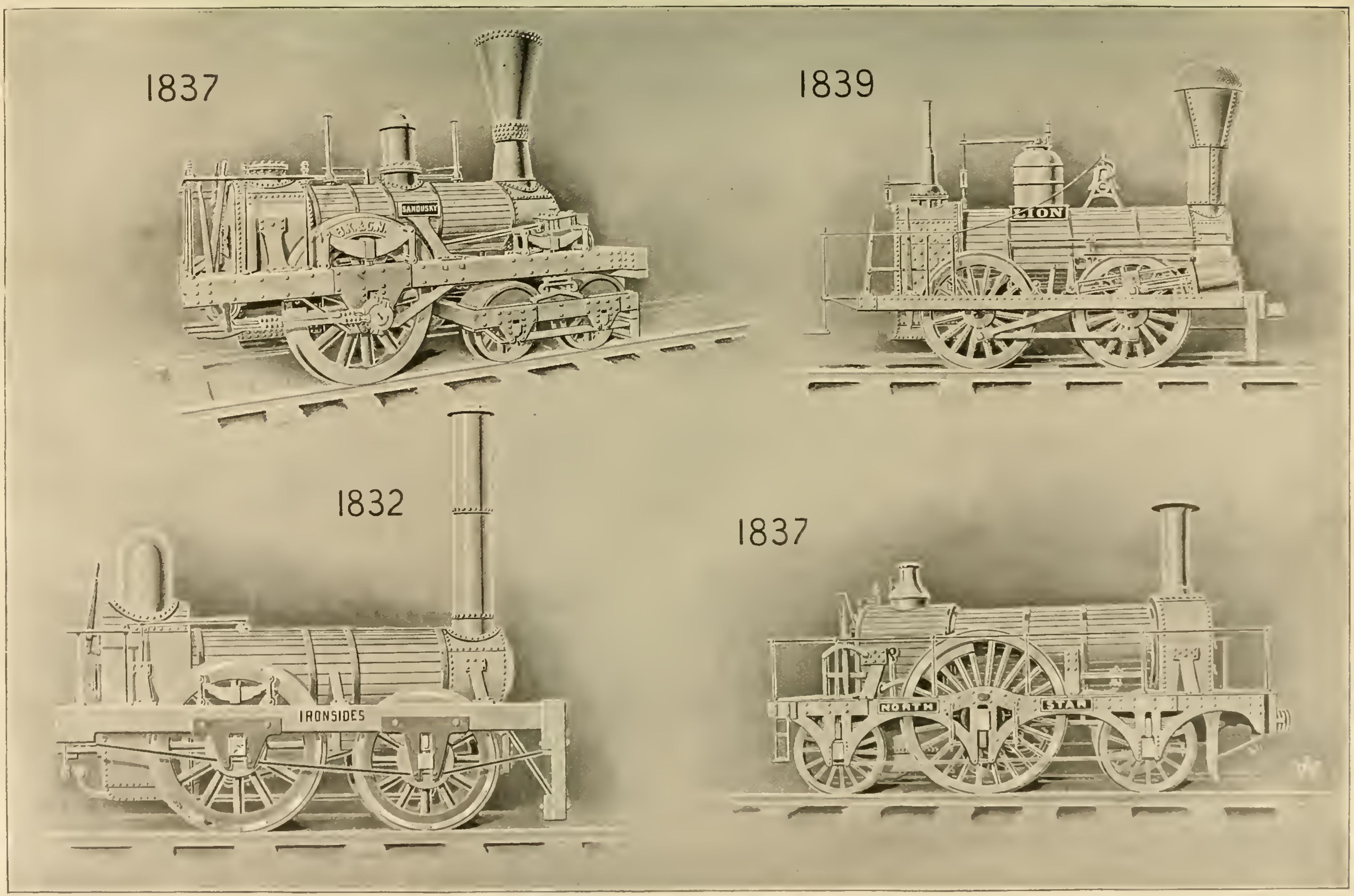
Italian Snow Plow.

The curious looking snow-plow hereby shown is the invention of a Mr. Bocca of Italy. The photograph, from which the engraving was taken, was sent us by Mr. Lewis Turo, of Turin, Italy. The object of the projections around the plow is to keep it from rising when clearing away very hard snow. Mr. Turo says, that they have a great deal of trouble with the ordinary slow plows in Italy jumping the track when the snow is hard, and he says that the improved plow prevents the accidents from that cause.

Foreign Commendation of Purdue University Tests.

The paper read by Professor Goss several months ago on experiments made with the locomotive "Schenectady," to ascertain the effect on fuel consumption of different sizes of grates, appears to have attracted a great deal of attention abroad, as well as in this country.

The "Revue Generale des Chemins De Fer," of France, devotes twenty-seven pages to the paper, and has an exhaustive article on the subject by M. Salomon, chief engineer of the Eastern Railway of France. The work which Professor Goss has done for mechanical science is very highly commended, and the method of carrying on the investigations is recommended as worthy of imitation by French engineers.



GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 5.

1837. "Sandusky." First Rogers and first engine to go beyond Ohio River.

1832. "Ironsides." First Baldwin.

1839. "Lion." First Hinkley locomotive.

1837. "North Star." First engine to make over 60 miles per hour.

Southern Locomotive.

The handsome ten-wheel engine hereby shown is used on the Southern Railway for running heavy fast-express trains and for fast freights. The engine is very popular on the road, and is noted for the freedom with which high speed is maintained.

These engines usually pull eight or nine heavy passenger cars, making a total train weight, exclusive of engine, of 438 tons when the nine cars are running. The grades on the first division are 82 feet to the mile, with a maximum length of 2½ miles.

Recently one of these engines ran from Charlottesville to Alexandria, 106 miles, in one hour and fifty-five minutes, with eight cars, six of them Pullman; weight of train, exclusive of engine and tender, 388 tons. One stop was made for water, and two slow-ups going through towns. There are several pretty steep grades between above places, one of 72 feet, 4 miles long.

The following are a few of the principal dimensions of the engines:

Cylinders—20 x 24 inches.

Drivers—66 inches diameter.

Boiler—58 inches diameter at smallest ring.

Weight of engine—129,000 pounds.

Heating surface of firebox—133 square feet.

Heating surface of boiler—1,682 square feet.

Total heating surface—1,815 square feet.

Valves—Allen Richardson, balanced.

Valve travel—5½ inches.

Adhesion at ¼—25,000 pounds.

Tractive power—20,363 pounds.

Hauling capacity on lever — 3,258 tons.

SOUTHERN RAILWAY EXPRESS LOCOMOTIVE.

Practical Instruction in Railroad Business.

In a prospectus issued concerning the work to be done during the coming year, the faculty of Purdue University show that they propose extending materially their studies in regard to railroad subjects. It seems to us, that while other seats of learning are talking about instituting departments of instruction in railway business, the faculty of Purdue University have established these departments and are widely extending them. There will now be eleven courses relating to railroad matters, which students will be able to follow. They are: 1—Railway Equipment. 2—Locomotive Performance. 3—Locomotive Laboratory Work. 4—Locomotive Design. 5—Railway Surveying. 6—Railway Construction. 7—Economics of Railway Location. 8—Chemical Laboratory Work. 9—Railway Chemistry. 10—Railway Economics. 11—Railway Sanitation.

The instruction to be given in these various courses appears to be very comprehensive, and will undoubtedly turn out men well prepared for work in the lines for which the scientific training applies. In connection with the Railway Department, the University faculty have arranged to have a series of lectures during the coming year, principally by practical railway men, as follows:

Jacob N. Barr, superintendent of motive, power, C., M. & St. P. Ry. Co., Milwaukee, Wis. (Subject to be announced.)

J. T. Brooks, second vice-president, Penn. lines west of Pittsburg. "Problems in the Management of a Railway System."

Frederic A. Delano, superintendent freight terminals, C., B. & Q. Ry. Co., Chicago. "Signalling."

Frank G. Darlington, superintendent, P., C., C. & St. L. Ry Co., Indianapolis. "The Management of Men."

Charles B. Dudley, chemist, Penn. Ry. Co., Altoona. "The Application of Chemistry to the Railroad."

Addison C. Harris, attorney-at-law, Indianapolis. "Railway Law."

Melville E. Ingalls, president of the Big Four system, Cincinnati. "Railways—Their Past, Present and Future."

George K. Lowell, general superintendent L., N. A. & C. Ry. Co., Chicago. "Practical Points in the Operation of a Railway."

John W. Noble, Ex-Secretary of Interior, St. Louis, Mo. "The Mutual Obligations of Railroad Corporations and the People."

Robert Quayle, superintendent of motive power and machinery, C. & N. W. Ry. Co., Chicago. "Business Problems of the Motive Power Department."

Godfrey W. Rhodes, superintendent of motive power, C., B. & Q. Ry. Co., Aurora, Ill. (Subject to be announced.)

Angus Sinclair, editor "Locomotive Engineering," New York City. "Reminiscences of a Locomotive Engineer."

Arthur M. Waitt, general master car builder, L. S. & M. S. Ry. Co., Cleveland. "Car Designing and Construction."

A circular has been issued by Secretary Cloud, of the American Railway Master Mechanics' Association, intimating that examinations at the Stevens Institute of Technology will begin on June 4th, to which persons eligible for the Master Mechanics' scholarship are invited to attend.

Planer Practice on Locomotive Work.

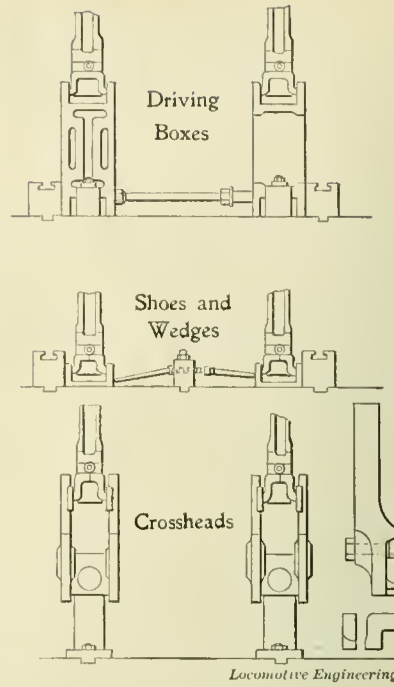
Our illustrations of the methods of handling some planer jobs at the Huntington shops of the Chesapeake & Ohio Railway, will be found interesting to those who have not reached the degree of development in such work as is plainly in evidence in the examples shown, which embrace shoes, wedges, crossheads and driving boxes.

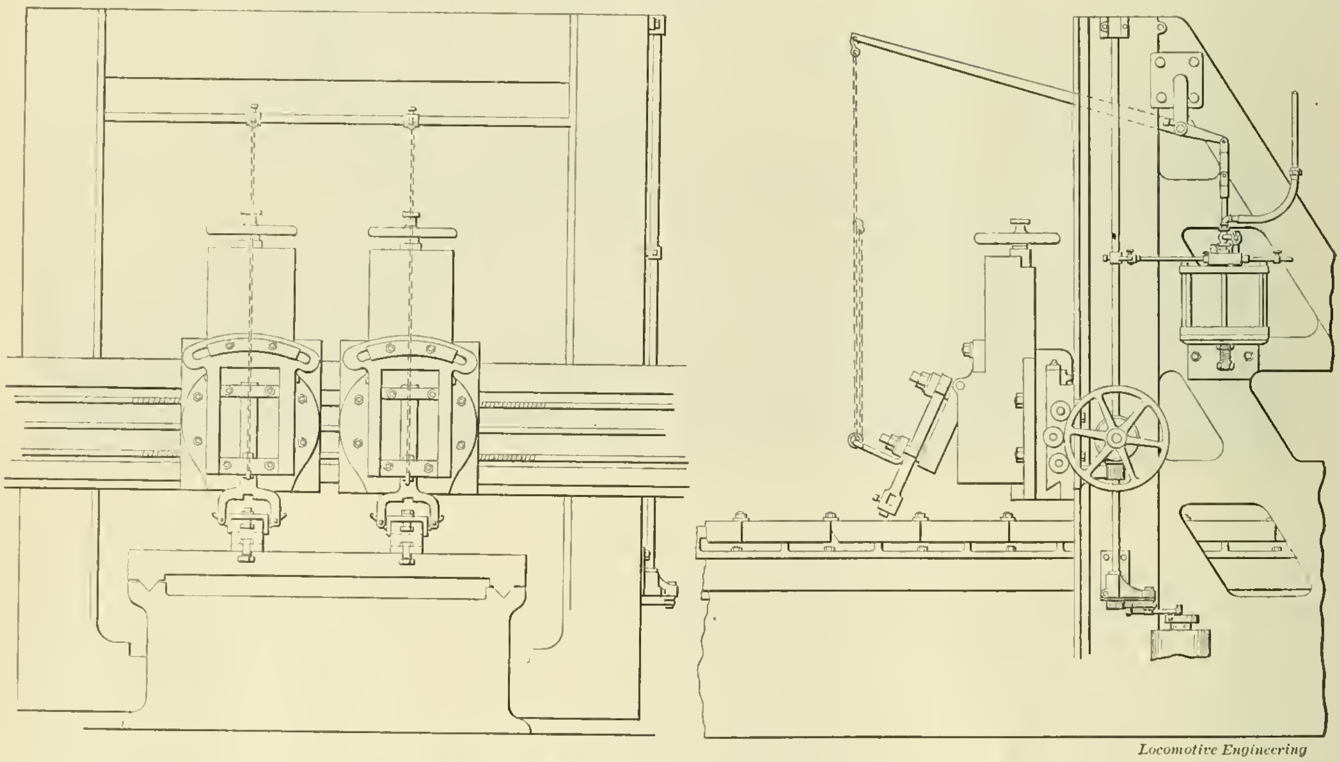
The double tool is used on these jobs with most satisfactory results. On shoes and wedges the cost for labor has been reduced from 38.75 cents to 13.25 cents each, and a proportionate reduction in cost of labor can be shown for the planing on crossheads and driving boxes, and other work done with these tools. The number of pieces operated on at the same time is, of course, an influential element in reducing the cost of labor; but the prime factor is the getting of stock off in two places instead of one, in a given period of time.

The removal of stock, however, cannot be accomplished to the best advantage, no matter how well the tools are devised application to most planer jobs makes it almost unnecessary to ever remove them from the machine.

It will be seen that the double tool covers a wide range of work, finishing the wedge fit on the jaws of driving boxes, the guide fit on crossheads, and the box fit on wedges and shoes, when a proper rig is adapted to the work to get the best results; but it will be an unpopular tool with the average planer man, without it is accompanied with an attachment to lift the tool clear of the work on the backing stroke, so as to avoid dragging and the consequent liability of a smash.

Such a device is provided, and it will be found to be fully up to the general excellence of the good things enumerated, without any ostentatious display of mechanism. It is automatic in all its functions, never failing to raise and return the tool to its proper position at the right time. Here, again, compressed air is the motor, acting through a small cylinder, shown located on the housing of the machine, on the operating side.





PLANER PRACTICE FOR LOCOMOTIVE WORK.

for the purpose, unless means are provided for holding the work rigidly against the cut. How well this is done is also shown in the engravings. An accessory common to all planers—the parallel strip—is made to perform a good share of the labor in the cases under consideration. They are gotten up on different lines from most parallel strips, since they are cored for lightness at the sides, and cast with a T-slot on the top for bolt heads by which to secure the work. The string of shoes on the planer platen shows these strips as an earning increment, and their endless

Air is admitted to, and exhausted from, the cylinder through a piston valve which receives its movement from the vertical feed rod by means of a lever connection to the valve stem, and the motion of the valve is timed and regulated by the two small dogs which are secured in place by set screws. It will be plain, from the engraving, that an admission of air to the cylinder will force the piston down, and by means of the lever to which it is connected, raise the chain at the opposite end, and with it the tool. Gravity returns the tool to its cutting position, the parts being amply heavy, with the aid of the leverage, to accomplish this movement unfailingly after exhaust takes place. The events of raising and lowering the tools are positive and correctly timed, since the valve is opened and closed by the feed mechanism.

These samples of good planer practice are taken to illustrate what is being done in a modern railroad repair shop, under the supervision of Master Mechanic A. F. Stewart, who has always been noted for his encouragement of labor-saving schemes.

Compressed Air Locomotive.

Our readers cannot fail to be interested in the compressed air locomotive now about commencing its trips upon the Manhattan Elevated Road in this city, and the accompanying half tones give a good idea of it, the first showing the frame of the machine and the tubes for carrying the charge of air, and the second showing the complete machine. The air at a pressure of 2,000 pounds to the inch is carried in 36 Mannesmann tubes, each 9 inches diameter and 15 feet 6 inches long, the cubical capacity being 246 cubic feet, which at the above pressure equals 33,702 cubic feet of free air. The weight of the full charge of dry air, by the way, will be over 2,500 pounds.

The tubes are all so connected, the connections all in the forward end and easily accessible, as to form one continuous reservoir. The air passes first to a pressure reducer which maintains a constant working pressure of 150 pounds, which may be varied within certain limits under the control of the engineer. The air after its re-expansion to this working pressure passes through a tank of water at a temperature of 350° Fahr. The water is heated and a portion supplied whenever the air reservoirs are recharged. The air in passing through the hot water is not only heated and expanded, but takes up a volume equal to about one-half of its own volume, the result of the expansion of the air and the mixture of the steam with it being to double the actual working volume of air.

From the heater the air goes as directly as possible to the cylinders. These are 13½ inches diameter and 20 inches stroke, being placed, as will be noticed, under the cab instead of forward. This arrangement is adopted principally to be as near the hot water tank as possible. As the cylinders on the steam locomotives of this line are only 12 inches diameter, the air locomotive will have more power, will start the trains quicker from the stations and will be able to make better time, although with other trains in the way there must be little chance to show this.

We are indebted to the "American Machinist" for cuts and description of this locomotive.

COMPRESSED AIR LOCOMOTIVE FOR NEW YORK ELEVATED RAILROAD.

Use of Valve Oil.

We have received from Mr. J. F. Walsh, of the Galena Oil Company, a small folder, giving directions to enginemen in the use of valve oil, which we find of sufficient interest to publish. The directions are:

"In one pound of valve oil there is, when fed through a lubricator in good repair, not less than 6,600 drops. Five drops feed per minute will ordinarily be found sufficient for the largest engine and heaviest service. For smaller engines or light service, a comparatively slower feed of oil will be found sufficient. One drop feed per minute is sufficient for an air pump.

"At a feed of five (5) drops per minute for each cylinder, and one (1) drop feed per minute for the air pump, you can easily obtain ten (10) hours of steady service from one pound of valve oil. Intelligent and economical results cannot be obtained unless enginemen know the rate at which the oil is being fed through the lubricators. If a small quantity of oil is put in a lubricator, time should be allowed for the condensation to fill the cup and raise the oil to the top of feed pipes, before feed valves are opened.

"Immediately after the oil is put in the lubricator, the steam and condenser valves should be opened. The steam valve should always be opened first, and opened full, and should be shut last. By bearing this particularly in mind, you will find the most of your trouble will disappear, the water in feed glasses will remain clear, and there will be no loss of oil by siphoning.

"If feed glasses become dirty, they may be cleaned by rubbing a little glycerine on the inside of the glasses.

"The feed valves should be opened and set a few minutes before starting on the trip, and if the lubricator is in good repair, there will be little or no variation in the feed between using steam and when the throttle of the engine is shut.

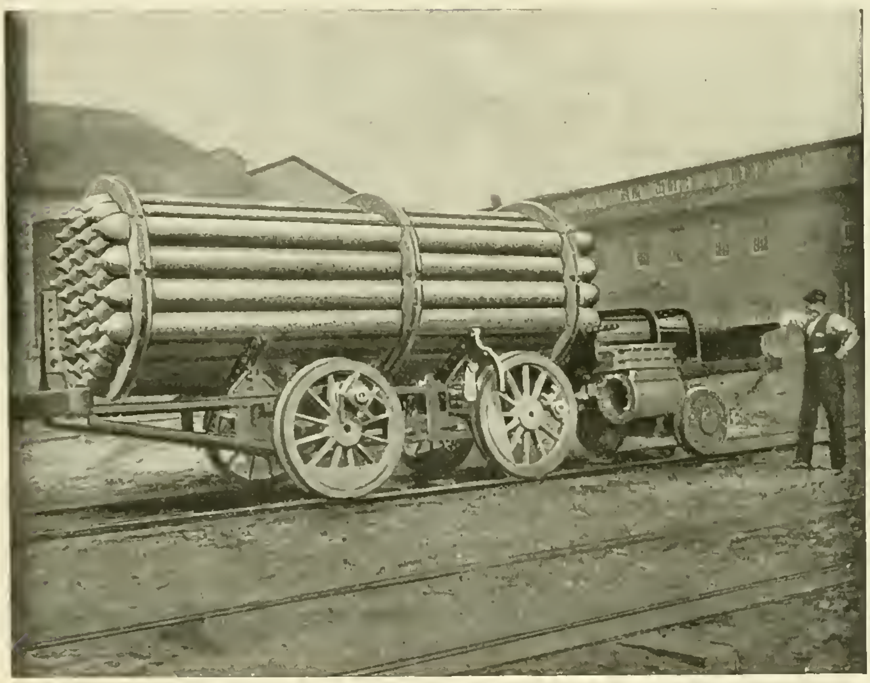
"If the feed of the lubricator increases when throttle of engine is shut, the lubricator should be considered out of repair. Irregularity in feed of lubricators is usually due to an enlarged opening in the choke plugs. The size of choke plug openings should not exceed $\frac{3}{64}$ inch. The size of opening in feed valves should not exceed $\frac{3}{32}$ inch. If the opening in choke plug becomes stopped up, it can be opened by shutting steam valve of lubricator and opening throttle valve of engine; the pressure passing up through the oil pipe will force the substance in the plug down into the feed glass. If the feed valves become stopped up, they can be opened by closing condenser valve and opening the drain valve; the pressure will then force everything up into the lubricator.

"Great care should be exercised when filling the lubricator to see that no foreign substance is allowed to go into it, as, owing to the smallness of the openings through which the oil passes, it does not take much to clog them.

"The temperature of steam at 140 lbs. pressure is 352 degrees. The fire test of valve oil is 500 degrees. If engine or other oils are mixed with valve oil, its fire test is reduced so as to ruin its value as a lubricant for valves and cylinders.

"Extravagant use of valve oil results in clogged up exhaust pipes and a consequent increase in coal consumption.

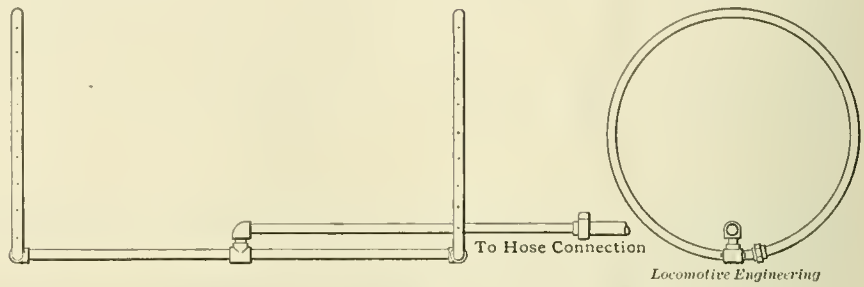
"When preparing your engine for a trip, do not give it a full throttle, as that practice forces all the condensed steam into steam chests and cylinders at one time, straining the joints and causing them to leak, which results in imperfect lubrication and a waste of oil."



AIR LOCOMOTIVE FOR NEW YORK ELEVATED RAILROAD.

Cylinder Heater for Applying Bushings.

Having had inquiries referring to the method of putting bushings into cylinders by expanding the latter, we illustrate the hollow perforated rings used for this purpose in the Huntington shops of the Chesapeake & Ohio Railway. The rings are connected by tees to a section of pipe about two-thirds of the length of the cylinder, and in the center of this connection is the pipe running to the gasoline and compressed-air tank. The rings are perforated in precisely the same way as would be the case for removing tires, except that they are on the outside of the pipe, so as to carry the heat against the wall of the cylinder.



CYLINDER HEATER FOR APPLYING BUSHINGS.

After the cylinder is expanded sufficiently, the bushing, which is previously turned to an iron and iron fit, and mounted on horses before the cylinder, is pushed into the latter by hand, and the cylinder allowed to cool.

By the old method of pulling the bushing in by a screw, it takes two men four or five hours to bring it into place. When put in by slightly expanding the cylinder with these heating rings, the time required is from fifteen to twenty minutes.

He Caught the Boat.

The following extraordinary incident occurred in Glasgow one evening last summer:

A man rushed into a railway station just as his train, connected with the Irish steamer, was leaving the platform.

"What am I to do?" he wailed to an official, and received, for consolation, the absurd advice:

"Wire them to wait for you."

This evidently struck him as a brilliant idea, for he there and then telegraphed to the steamer at Greenock in these terms:

"Party missed connection; await next train," and appended his surname by way of signature.

The captain, who for some time previous had been expecting any day a visit from one of the managing owners (of the same name), on receipt, concluded it came from one of his principals, hurriedly took advantage of the time at his disposal to replenish his commissariat, and—waited for a steerage passenger.

The gentleman had a very stormy interview with the captain in his cabin, for, as our readers are aware, the captain of an important steamer would not wait for an omnibus-load of Dukes under ordinary circumstances.—"L. E. & F. Journal"

Lack of speed, lack of comforts, lack of cheap rates, are the charges brought against the German Empire's Railways by the report of the Imperial Commissioners sent a few years ago to study the United States roads. Of the report which has just been issued, Consul Monaghan, at Chemnitz, writes the State Department that the Commissioners went all over the Union, covering 8,079 miles. The New York Central & Hudson River Railroad is put down as one of the world's best roads, with its express train to Chicago covering 969 miles in twenty hours. From Leipsic to Rome, 945 miles, takes thirty-five hours. It is only when compared with European routes and time taken, that the enormous time saving in the United States can be realized.

In a private letter, recently received from Mr. W. F. Dixon, chief engineer of the Sormovo Company, Nijni Novgorod, Russia, he says: "You will probably be interested in knowing that we have started up all our bolt and nut-making machinery, together with a planer, shaper, lathe and drill press, and I can assure you it is a great relief to see at least one length of line shafting going round."

A Reporter's Improved Locomotive.

A space reporter of a Seattle newspaper, wrote up the description of a locomotive newly got out of the Northern Pacific shops at Tacoma by Master Mechanic H. H. Warner, and as usual the engine was made out to be a wonderful machine.

The engine was reported to be very popular on the road on account of immense saving in the consumption of fuel, which was brought about by improvements, patented by Mr. Warner. The principles of these fuel saving devices were reported to be, a new piston valve and ratchet "quadrad," evidently meaning quadrant. These new appliances were said to economize in the use of steam, and consequently the amount of coal consumed was decreased. Another important improvement was said to be the smoke stack, which runs more to the bell shape and causes a perfect vacuum; while the exhaust steam, instead of going through the stack, goes back into the boiler and assists in heating the water. This can readily be seen, says the reporter, effects another saving. Another improvement was said to be a set of patent piston valves, instead of the old grooved valves. These are set above and apart from the boiler and are so constructed that in case of an accident, in which they might be broken off, no steam or hot water could escape, which means greater safety to the engineers and firemen.

Perhaps more wonderful than the piston valves stuck above the boiler, was the statement of the reporter, that this engine pulled a heavy freight train 28 miles and switched four hours on an expenditure of three-quarters of a ton of coal.

Superintendent Charles Selden, of the B. & O. Telegraph, said the other day that the average number of messages handled every day on the B. & O. system was 53,000, exclusive of train orders. The B. & O. has 22,252 miles of telegraph wire, of which they use 7,240 for company's business, and the balance is leased to the Western Union. There are 384 telegraph offices on the line, of which 234 are reporting Western Union offices. Mr. Selden employs in his department 750 men, exclusive of linemen. He also has charge of the block signal offices, which, east of the Ohio River, average one to every six miles. The service of the company's plant is considerably augmented by the use of several multiplex systems.

Box Tool for Turret Lathes.

The tool that we illustrate, as used on turret lathes for brass work, does not represent the vogue in any considerable number of railroad shops, and for that reason we are desirous of bringing it before those who may be still turning and threading brass work by antiquated methods on 12 or 14 inch lathes, in harmony with early teachings on the lead-screw order.

One tool only is shown, which will give a clear idea of its possibilities when viewed in connection with the samples of its output. Fig. 1 shows the tool holder

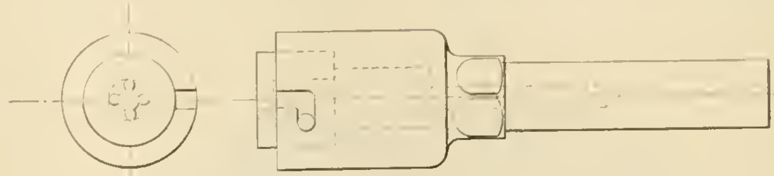


Fig. 1

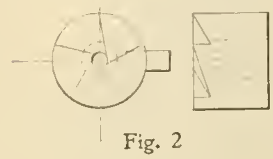
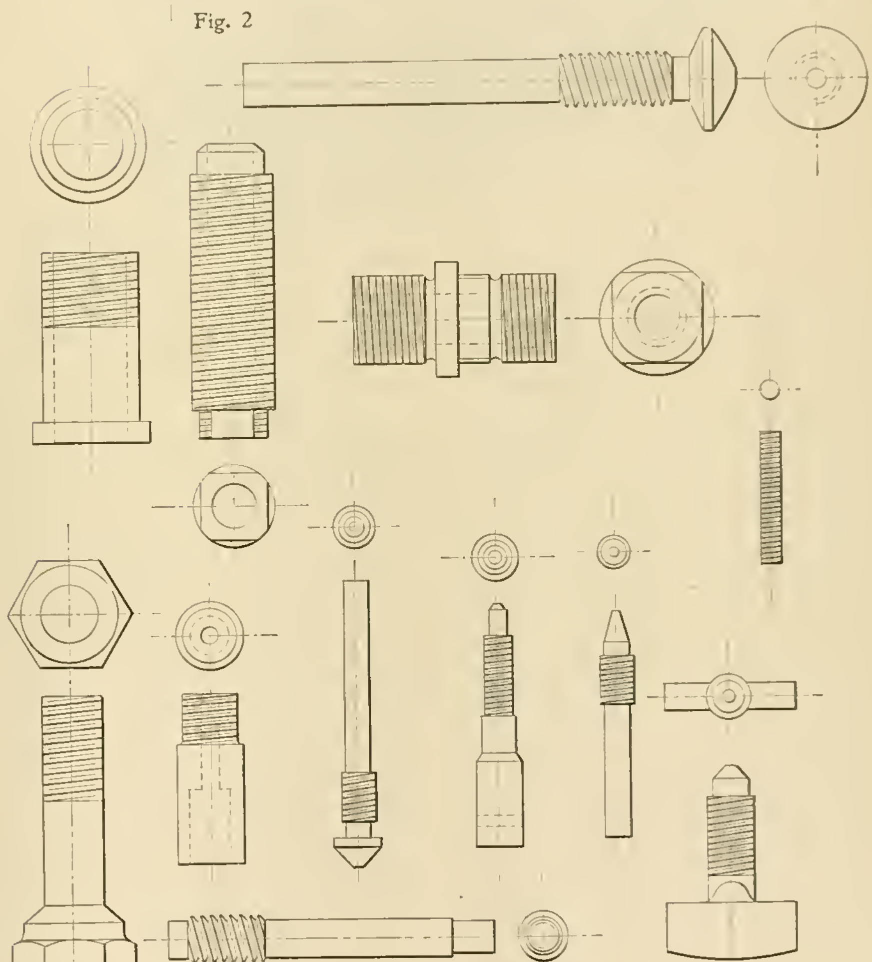


Fig. 2



WORK OF A BOX TOOL.

with the threading die, as used in the turret; the die fitting a counterbore in the end of the holder, which is cut on its end face with an L-shaped slot, to receive a locking dowel solid with the die. Fig. 2 is the cutter die, and is a counterpart, in exterior dimensions, of the threading die. It is simply an end mill with a hole through its center, of a diameter corresponding to the size required of the finished piece, which in this case is ¼ inch, matching the threading die shown, both of which are used for small screws used by electricians for binding posts.

A cutter made on this principle will work up any size of stick brass from ¼ inch, the diameter of the hole, up to 1¼ inches, which is the outside diameter of the die—a range of sizes which guarantees a sure thing from material in stock.

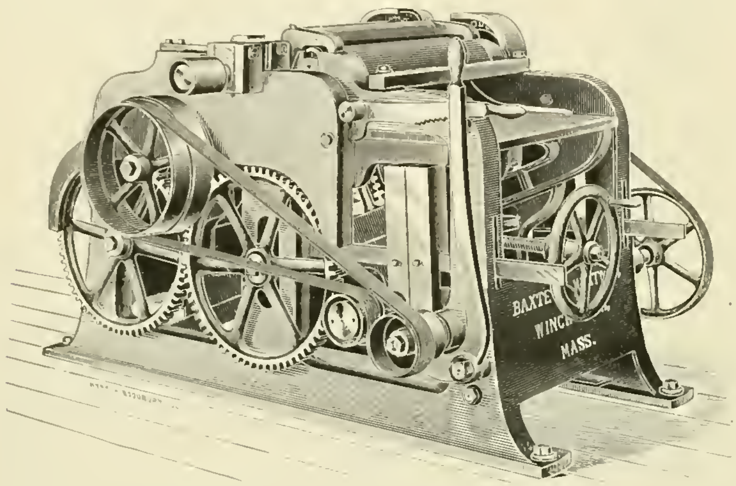
The variety of work possible with tools of this character makes them almost indispensable in any shop, as the examples given will bear witness to, and which can be easily demonstrated by applying a turret, with its accessories, to any ordinary lathe in fair condition. These tools are in extensive use in the Huntington shops of the Chesapeake & Ohio Railway—one of the railroad shops whose management insists on getting the best out of tools.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Whitney's New Planing Machine.

Our engraving of the Whitney planer illustrates one of the new wood-working tools put out by a builder whose name is a sufficient guarantee of quality of workmanship and efficiency in performance. It is a single surfacer, made in sizes from 24 to 48 inches in width, varying by 2 inches to suit any requirement for that dimension. There are four feed rolls 5 inches in diameter, running in adjustable babbitted boxes, the rolls having four changes of speed. The feed is controlled by a belt-tightener easily manipulated by the operator, and all roll gearing is covered by protective hoods of cast iron.

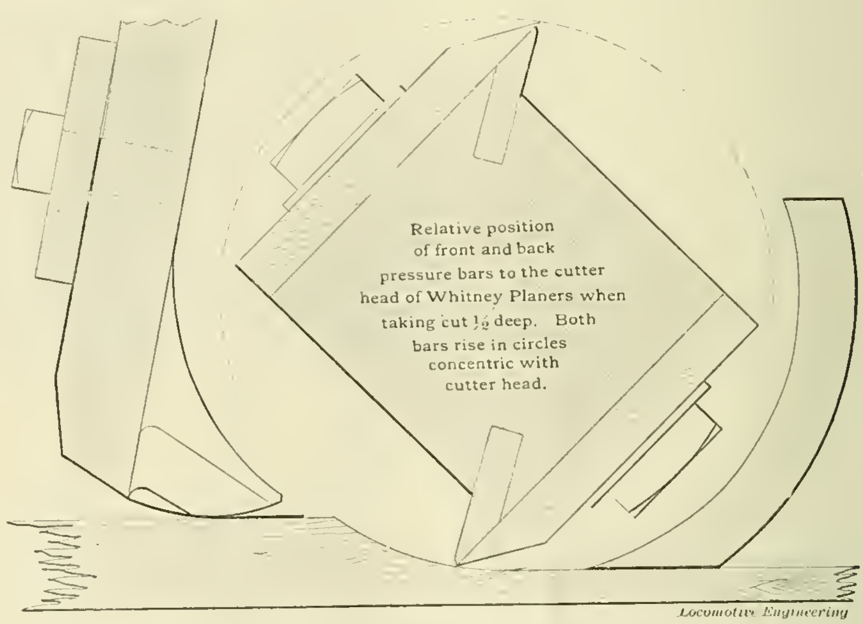


WHITNEY'S NEW PLANING MACHINE.

The material used in the cutter head—the best tool steel—gives a greater rigidity, and takes a more satisfactory temper than the ordinary steel usually entering into the construction of this important detail of the planer, and in consequence of the attention bestowed on it, the liability to deformation and consequent heating is practically an unknown quantity. The 2 x 10-inch journals held in place by the White patent clamp boxes and the lubrication by means of the automatic oil circulating device, are, of course, largely responsible for the cool running of this machine, but the prime reason for satisfactory results must be looked for in the material and workmanship.

Much attention has been given in the past to the design of a practical feed roll of the short sectional type, that would be sufficiently yielding when unequal pressure was brought on it, as when planing several pieces of unequal thickness at the same time, so that thin pieces would not stop, while the thicker work continued on under the roll. The failures in this direction are best understood by those who did not reach the goal aimed at. It remained for the Whitney sectional roll to fill the void. The sections of these rolls are only 1 inch long, which allows them to feed very narrow stuff. Such are the patent rolls in use on the planer illustrated.

A special detail of the patent pressure bars on this machine is also presented, for the reason that it is a well worked out detail to accomplish an end, and also to show why these planers do the good work they are noted for. They are made so as to give to the inequalities of the lumber in all directions. The bars are placed one at each side of the cutter head, and by their peculiarities of construction, press on the work at the nearest possible point to the edge of the cutter; the relative position of the pressure bars and cutters always remaining constant, regardless of the thickness of stuff or amount of the cut. A machine thus fitted has the important advantage of planing stuff less than 3 inches long without clipping the ends. The front pressure bar will be seen to have a flexible spring under it which extends back toward the cutter, and very close to the line of motion of the latter.



CUTTER-HEAD OF WHITNEY'S NEW PLANING MACHINE.

The builders do not seem to cover the whole range of possibilities of the tool when they claim that it will plane material from 1-16 to 7 inches in thickness. A sample of work in our possession, done on this machine, shows a piece of ½-inch stuff, 2¼ inches wide and 3¾ inches long, which was reduced to 0.014 inch at one cut, under a feed of 16 feet per minute. The micrometer caliper shows the thin part to be remarkably uniform in thickness. Work as true and thin as this, is a crucial test of any tool of the planer type, and is certainly a good example of work from the high-class wood-working tools made by Mr. Baxter D. Whitney. Mr. Whitney's works are at Winchendon, Mass.

Fire-Extinguishing Car.

Upon some railroads the switching engines, or those which do the yard drilling, are equipped with a pump, to be operated by steam from the boiler and a suction arrangement, so that they may draw from the contents of their tanks or from any other convenient source of supply for the extinguishment of fires.

At the East Buffalo yards of the New York Central & Hudson River Railroad another system is in operation, calling into service in the protection from fire of a specially designed and operated car. This is, in its first estate, a flat car 34 feet long. The car has two water tanks, one at each end, and each tank has a capacity of 3,500 gallons. The pump is placed in the middle of the car, between the tanks. Over the pump there is a cab, forming a pump house. The car is equipped with a duplex fire pump with 12 x 12-inch steam cylinders and 8 x 12-inch water cylinders. The water discharge is arranged for three 2½-inch hose connections, so that three streams can be used at one time. The steam for running the pump is supplied by the locomotive used to draw the car. The car is fitted with standard steam couplings, so that any available engine may be used to operate the pump. The hose rack in the car is close to the water connection, and the hose is at all times attached, so that it can be run out of a window on either side of the cab. There are also two reels carrying 300 feet of extra hose.

With a pressure of 80 pounds of steam and a 1-inch nozzle, and throwing through 100 feet of hose, the distance of stream as taken from time to time has been from 160 to 170 feet. With one such stream, the capacity of the car—that is, the storage of the tanks, would be 50 minutes to an hour of service. This car is kept close to the switching tracks, where it may be easily got at in the event of fire, and in the night time an engine is kept coupled to the car. The experience with this car is, that it has never failed to be ready for duty in five minutes, and that when working alongside the city fire engines, it has always been able to surpass them in duty.

WORK DONE BY WHITNEY'S PLANING MACHINE.

Large Order for Steel Cars.

About the time we went to press last month, the Pittsburg, Bessemer & Lake Erie placed an order with the Schoen Pressed Steel Company of Pittsburg for the construction of 600 cars, to be made of steel. Some months ago, the railroad company named, asked various car and bridge builders to make tenders for the construction of 200 cars, built entirely of metal. Those desiring to bid on the contract were asked to furnish any modified designs that they might desire, with prices, as well as price on design which had been worked out by the engineers of the Carnegie Steel Company.

After the bids were all in, the contract was awarded to the company above named. Half of the cars will be built according to the plans submitted by the railroad company, and the other half will be built according to a design which has been worked out by Mr. Charles T. Schoen. Half of the cars will be equipped with the Schoen Pressed Steel Co.'s pedestal type of truck frame; the balance with the Fox, Kindle, Cloud, Pennsylvania Railroad and Goltra types of truck frames.

The Schoen Co. undertook to deliver the cars in ninety days, which is extraordinarily prompt work for cars of a new material. The peculiarity about the cars is that they are 100,000 pounds capacity, and will be employed for hauling ore between Lake Erie and the Carnegie Steel Works in Pittsburg.

The rest of the railroad world will watch with a great deal of interest this important move, in favor of cars of great capacity made of the strongest material to be found If the cars give entire satisfaction in service, their construction will be the beginning of a revolution that will substitute steel for wood in car construction. The builders of the cars estimate that there will be a saving of 5,000 pounds of dead weight per car over what it would be with modern cars, built of wood and iron. Owing to the low price of steel, the material will not cost any more than for cars of the same capacity made of wood.

Origin of the Short Caboose.

The short caboose now standard on many roads was not the result of deep thought at the drawing board, nor was it brought to its present form to meet any set conditions. It simply evoluted from a box car that had been in the ditch, and had broken in two equal parts. When the question of salvage came up, it was proposed to scrap the wooden members of the car and use the iron for repairs; it was at this stage of the conference between the interested officials that the bobtail was born.

Mr. C. A. Smith, the veteran master car builder, and, by the way, one of the organizers and most devoted spirits of the M. C. B. Association, was at the time of the inquest over the wrecked box car, in charge of the car department of the Erie, and when it came his turn to make some kind of a proposition looking to a disposal of the remains, he suggested that he be permitted to build two cabooses out of the framing that survived the smash, having in mind the lack of proper accommodations for train crews at that time. The proposition received the seal of approval, after the usual oratorical pyrotechnics over the expense of the job.

Applying platforms, and making a four-wheeled truck, the frame of which was secured to the sills of the car, and equalizing the load on the wheels, constituted the greater part of the job, which, when completed, was practically the short caboose of to-day. These short cars became so popular with the crews that no time was lost in building a full equipment, without waiting for wrecks to supply the incentive, as in the first instance, a number of them being only ten feet long. This occurred in 1854—forty-three years ago—a period that was alive with precedents in rolling-stock work, the influence of which is constantly cropping out in the construction of the present time.

Car Journal Boxes.

The following are extracts from a paper read by Mr. George W. Cushing before the Western Railway Club on "Locomotive and Car Lubrication":

"In the use of plain brasses, and those of composite or fancy mixtures, it is at times found that the metals are not thoroughly well mixed in the melting. Undue haste in pouring or careless work, no doubt, is the cause, and trouble usually develops in such cases at the center of the bearing. Heating takes place gradually, until, perhaps, after many miles' running the bearing goes from good to bad very rapidly, and, perhaps, under the best possible condition of lubrication, a regular incurable hot-box is the result. If the bearing be broken or cut in halves, the cause is in this case found to be a bad mixture of metals. It does not follow, however, that all cases of brasses scaling in spots are due to bad mixtures, for this may occur in the case of a foreign substance getting to the bearing surface and causing the local seizing, which produces the surface scale. Nor does it follow that because of bad mixture the metals are bad in quality, as better treatment in remelting will probably produce a good bearing.

"There are a number of faults which occur in the alignment of the trucks, which have a more or less injurious influence on the bearings and journals. The tipping of oil boxes is often found. I have noticed journals worn tapering more than ¼ inch in their diameter from this cause in both freight and passenger cars, and I have seen trucks so skewed out of line that the bearings were worn to knife edges at opposite diagonal corners. The journals were badly worn also, and new bearings were put in place with great difficulty. In passenger trucks using the usual form of pattern of spring bolster, the position of the bolster springs, as also the equalizer springs, affects equalizers, giving to them at times an unequal bearing on the top of the oil boxes, and producing the same result on the journal bearings. Pedestals are also pushed outward, affecting all other parts in due proportion. The tipping of the oil box in turn tips the brass, wearing it unduly at the rear end and tapering the journal.

"Another faulty and improper condition is a box or wedge bearing on the top of the brass at the center, which is so limited in extent as to place all the load at the center of the journal and wear a hollow journal. Again, in the case of a flat bearing or wedge, this may be cast so rough at one end or at the center as to make the same condition of hollow journal at the center or taper end.

"It has been stated that brasses may be faulty in the mixtures of the metals. This may also occur in white metals, but is troublesome in a much less degree, because of the difference in metals. White metals are usually made of lead and antimony, with perhaps an admixture of tin, as in the case of brasses treated as are the Hopkins lead-lined bearings, so successfully used in times past in passenger trucks. In the case of shell bearings the metal is lead and antimony. Experience with bearings of brass and composite metals has led me to favor the use of white metals, as mentioned above, because of less cost, and because, also, these bearings readily adjust themselves to the ordinary condition of journals. They are much less liable to heat in getting a bearing in running order, and there will be less wear of the journal and of the bearings at any speed, so long as the lubrication is attended to, and when not properly cared for the white metal will care for itself much the longer. The white metal bearings will consume less oil per 1,000 miles run, and will remain in good condition with much less labor than plain brass bearings, and they are also good to have available when needed in emergency service, and as a preventive of train delays."

Turntable for Headlight Glass.

A very useful tool is shown in our illustration of the device for cutting glass to a circular form. All sorts of modifications of this arrangement have been in use for some time, but the one shown embodies all the good features of the best of them, leaving no opening for extensive improvement, and on that ground it is presented to our readers.

It is durably built, comprising a cast-iron base having a boss at one end, which is bored to receive a cylindrical projection that is turned on the lower face of the hub in the center of the table; the latter also of cast iron and revolving with the glass to be cut. At the opposite end of the base is a column, with a long bearing at the top, through which slides the bar carrying the diamond over the turntable. The bar is held rigidly in place by means of a screw with a milled head, the screw bearing on the flattened top of the bar. The diamond is carried in the end of a small spindle, and is held clear of the glass by means of a light helical spring; the upper end of the spindle being provided with a head by which to press the diamond to its work.

The table is lightly grooved with concentric circles one inch apart, to facilitate the setting of the diamond to cut any diameter up to 26 inches. All shackly features are absent in this tool, as would be expected of anything built at the Huntington, W. Va., shops.

Oiling Cylinders

BY CLINTON B. CONGER.

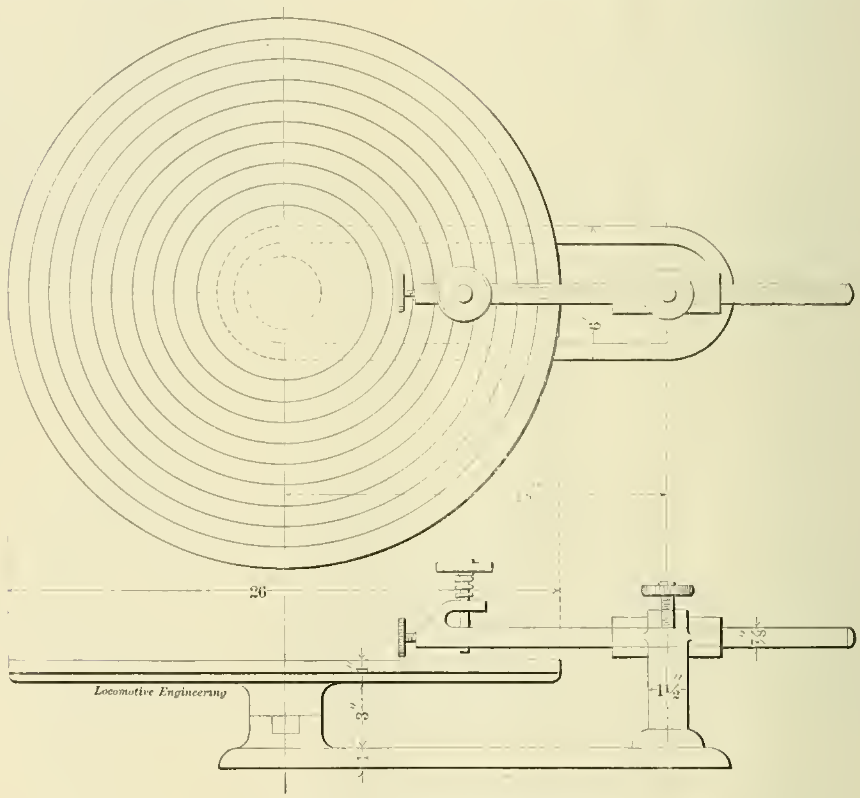
Some years ago, before we had any Nathan and Dreyfus cups, or sight-feed lubricators, most all locomotives had their valves and cylinders oiled by pouring the oil, or melted tallow, direct into steam chest through an oil cup on steam-chest cover. Before long, to make it safer and more convenient for the firemen to oil the valves, these steam-chest cups were moved into the cab and connected to the steam chest with an oil pipe, so it was not necessary to go out on the front end to oil the valves.

Directly after this change was made, the complaint was heard that the valves did not seem to get the benefit of the oil as with the steam-chest cups, the reason alleged being that the oil did not run down for three or four minutes, but stayed in the pipe till engine was shut off the next time. As it was the practice on long fast runs to shut off between stops, to oil the valves, and pull out as soon as the oil had run through the cup, the old veterans of the throttle declared that the oil did not go down through the pipe unless the steam valves on boiler head were opened each time after oiling, to blow the dose of oil down through the pipes to the steam chest.

Then, when we began to use the Dreyfus oil cups, which operated by the steam condensing in the space above the oil in top of cup, and condensed water displacing an equal amount of oil, which passed down the pipe through middle of cup, another "kick" was made that these cups did not feed any oil when engine was working hard, only at the instant of shutting off.

As very few of these cups are now in use, it is hardly worth while to go into a detailed explanation of how these Dreyfus cups operated. However, the writer used one for some months in 1875, and made a test of it by running 66 miles without shutting off, with engine cut back far enough to maintain about an even pressure in the steam chest for the whole distance, which was run in three hours. During that trip, exactly one-half gill of water was condensed in the two cups, each holding a quart. The cups were refilled with oil, and our train to take back was made up, which took 1½ hours of fast switching, making short pulls each time, so engine did not work steam but a few minutes at a time. When the train was made up, all the oil in the cups had fed out, showing that some of it went out each time the steam-chest pressure dropped to nothing.

When we got sight-feed lubricators in 1883, the steam feed out of cup into oil pipes was regulated with a hand valve, much the same as the valve which regulated the oil feed; this was before the



TURNTABLE FOR HEADLIGHT.

"chokes" now in general use were put in. To make the cup feed regularly when working steam or shut off, it was necessary to choke the steam feed down very fine to the oil pipes, and have a full opening from the boiler to top of lubricator.

With these cups in operation, especially if engine was working with full throttle, and cut back pretty short, when the valves began to pull on reverse lever too hard, it was customary to reach over to the lubricator and open the oil feeds more, so a greater number of drops were fed per minute, to give the valves more oil.

The writer, in common with others who took an active interest in these curious facts in connection with oiling the valves on long, heavy runs, soon found out that giving a larger supply of oil from the cup did not seem to help the hard pull on reverse lever any; but if we eased off the throttle, and unlatching the lever, let it drop down towards the corner and pulled it back to 10 inches, two or three times, the valves seemed to handle easier. This operation appeared to prove that the oil stayed up in the oil pipes for some time after throttle was opened full, and increasing the oil feed at cup did not give any greater supply to the valves immediately. But just as soon as the throttle was eased off, which reduced the steam-chest pressure, and lever dropped towards corner for an instant, the steam, oil and condensed water in the oil pipe expanded towards and into the steam chest at once, and its effect could be felt in the reduced pull on the lever.

To prove this theory for yourself, when the lever pulls hard, and you can see that the cup is feeding into the oil pipes, do not increase the oil feed beyond the usual number of drops, but "feel of the valves" by pulling the lever up and down between the corner and 10-inch notch, first easing off on throttle, and note the effect. This can be done at any time without reducing the speed of train very much; its effect will be to make the engine work smoother and more powerful; besides, it makes a man feel less nervous to have the reverse lever let up on its jerking a little.

This may sound queer to some, but try it for yourself.

Some months ago I put a gage glass in the oil pipe where it enters the steam chest, on a Rhode Island ten-wheel engine with balanced valves, full-sized steam inlet ports into the chest, 18 x 24-inch cylinders, 48-inch wheel centers, using a good make of lubricator of recent pattern, carrying 160 pounds of steam and pulling a full train of freight. When the throttle was opened, the oil pipe filled up from the steam-chest end, forcing back the oil and milky water which had been trickling down the inside of glass tube, everything being cleaned out by the rush of steam from steam chest towards lubricator, nothing but clear water or steam showing in the glass till the throttle was shut off for the next stop, ten miles run, thirty minutes afterward. The instant engine quit working steam, a discharge of oil and milky water was seen passing through the glass tube towards the chest, apparently about the amount we would expect to see from five drops a minute for thirty minutes; but it flashed down through the glass tube so quickly that it looked like a white spot followed by a black one. When working hard, if the engine slipped, and was shut off for an instant to stop her slipping, there was a discharge of oil and water; but while engine was working steadily, nothing but clear water and steam was seen in this gage glass. The same phenomena were observed on the next run of twenty-five minutes. A test was afterward made by taking out the choke plug on that side of lubricator, and putting in one with an opening through it of ⅛ inch, so a larger supply of steam came into the oil pipe on that side. In ten minutes the first discharge of oil was seen passing through the glass; three minutes after, another supply passed down, and at intervals of two or three minutes afterward.

This goes to show that when the steam-chest pressure at one end of the oil pipe, and the boiler pressure at the lubricator, are anywhere near equal, the steam and oil feed through the small chokes very slowly. Enlarging the chokes tends to equalize the difference between these pressures at a much higher rate of flow through the oil pipe towards the steam chest. The size of the oil pipe may have something to do with this rate of flow towards the steam chest. If we accept the theory that the oil and such condensed water as is in the oil pipe, flow out of the oil pipe into the steam chest just as fast as the lubricator feeds it in at the other end, it would be an advantage to have a pipe with a small bore, say ¼ inch. Surely, if the pipe must be filled its whole length before any can run out, a small pipe would be filled much more quickly than a large one. On the other hand, using an oil pipe with a large bore, say ⅝ to ¾ inch, would allow the steam to work up along the top, and the oil and condensed water to flow down along the bottom, at the same time.

Enlarging the chokes, however, has a bad effect; it will admit too much steam to the steam chest when throttle is shut off, so the engine is likely to move when you expect her to stand still. If the chokes are larger than standard size, the cup will not feed at the same rate with engine working steam as when shut off—another fatal defect. Some device that will have a strong current of steam through the oil pipe when the engine is working steam, and a small current when engine is shut off, would help out this trouble.

Moving the chokes into the end of the oil pipe at the steam chest, overcomes this trouble, but introduces a more dangerous one; if the chokes stop up, as they are liable to do, no oil can be got into steam chest till choke is cleaned out. As it will not notify you it is choked up till too late, you cannot take measures to remedy it till some damage is done to the valves. Then the position of the chokes in the steam-chest plug, instead of right at the lubricator, would seriously interfere with the use of the hand or auxiliary oil cups, if it should become necessary to use them. A washer with a small hole through it, placed in one of the joints near the steam chest, is open to these objections also.

Bear in mind that the flow of oil from the cup to the steam chest is affected by so many local conditions which are modified by every change in the manner of working the engine, that the tests do not always show the same results, as I soon found out. Others who have used this test glass will bear me out in this. Generally, however, if the steam-chest pressure is much less than the boiler pressure in the cup, the flow of oil from the cup to the steam chest is not held back very long after opening throttle, so that an engineer who does not work any wider open throttle than is necessary to have the engine do her work, need have no fear of cutting valves on a long run. If you have an engine that can always handle her train with part of her available power, or always run with as little throttle as possible, and change it to keep an even speed up and down grades and ease off a little on sharp curves, you will never know of this difficulty. Or, if you have an old-style engine, with steam passages so small that steam, on its way to the steam chest, is wire-drawn so the chest pressure is lower than boiler pressure every time the valve uncovers a steam port, you will not notice it. But if you work an engine with full throttle, and depend on the reverse lever to regulate the amount of steam used, look out for an intermittent flow of oil. The steam pipe from boiler to top of cup should be at least ⅜ inch inside diameter, and steam valve full-sized opening, so a full supply of steam will reach the cup. If these pipes and valves are too small, look out for trouble. If the valves seem to get dry, shut off a very little, drop the lever slowly for an instant, and see if that does not help them.

Grand Rapids, Mich.

The torpedo boat No. 6, recently built for the United States Navy, is the fastest vessel that has ever been built in America. In the course of a trial trip, she maintained a speed of 33 miles an hour, which is about as fast as our local passenger trains run. The engines were powerful enough to turn the screw 405 revolutions per minute, steam of 220 pounds pressure was carried in boiler. The boilers are of the water tube type.

Practical Letters from Practical Men.

Inside Pipe Cutters.

Editors:

For the purpose of removing flues from boilers, casings from bored wells, and cutting piping generally where only the inside of the pipe is accessible, a distinct type of cutter is used, known as the inside pipe cutter. One of the simplest forms is that shown in Fig. 1, by which a chisel-shaped cutter is forced through the side of the flue, and is then withdrawn and adjusted for other cuts in the plane of the first one, until the entire circumference of the flue has been severed. The flue cutter consists of two arms hinged together, one of them carrying a bearing block, and the other carrying a cutter, these parts being secured to the arms by dovetailing. The cutter has a long edge to secure a cut of considerable length. A pair of strips having laterally extending ears, is riveted to each arm, and a bolt, forming a pintle, passes through these ears. The bolt lies in semi-circular grooves in the faces of the arms, and thus relieves the ears of strain. When the long ends of the arms are closed together, the cutter and bearing block are forced apart and the cutter penetrates the wall of the flue.

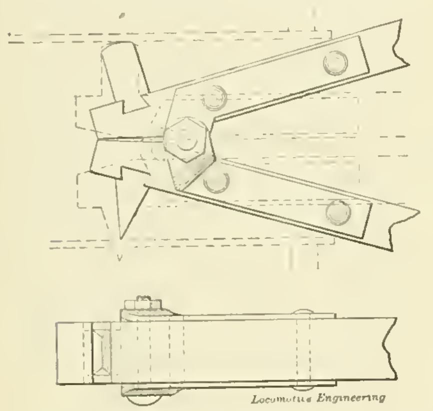


Fig. 1

PIVOTED ARM CARRYING CUTTER AND BEARING BLOCK.

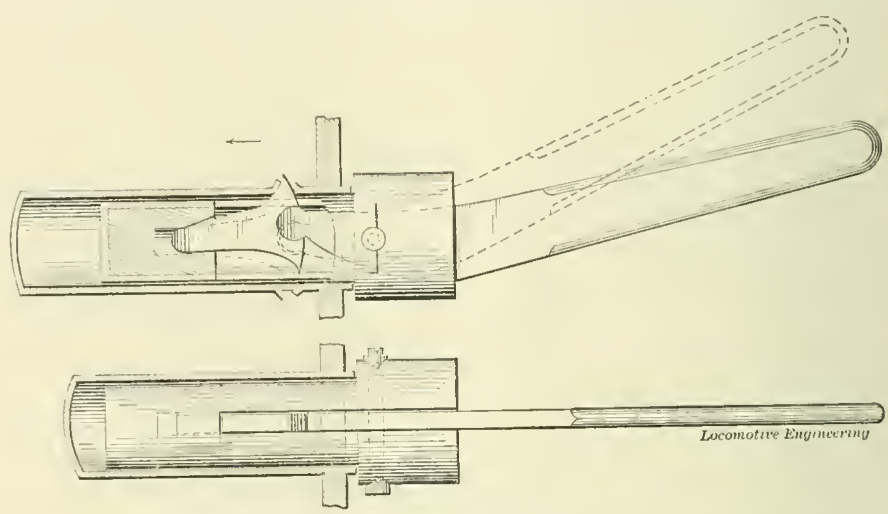


Fig. 2

DOUBLE OSCILLATING CUTTER.

A cutter which is somewhat more complex, but which is capable of more rapid manipulation, is shown in Fig. 2. The moving parts are mounted in a hollow cylindrical body, having an enlarged head, which rests against the outer end of the flue. A lever is pivoted in the head, and its round-nose shorter arm engages a similar-shaped notch in the forward end of a cutter, which cutter has an upper and a lower cutting edge and a rearward extending shank. The shank is made tapering, and rests in a tapering hole in a rubber socket at the rear end of the cylindrical body. This body is provided with slots through which the cutter may reach the flue. The body is inserted in the flue, and the lever is first depressed, to force the upper cutting edge through the flue, and then raised, to cause the lower cutter to operate. In this manner the cut is carried entirely around the flue.

In Fig. 3 is illustrated a simple cutter by which the entire circumference of the flue is cut at once, the tool being operated by the blows of a hammer. The cutters are mounted on a long, tapering mandrel, having three dovetail grooves, in which fit the feet of the cutters. A nut on the small end of the mandrel prevents the escape of the cutters. The cutters are segment-shaped pieces, having cutting points on their outer edges, and they are secured together in pairs, and one edge of each cutter projects beyond the adjacent edge of its companion cutter, and overlaps one of the cutters of the next pair, so that the pairs of cutters are interlocked and all move together. Bolts having three-arm heads are secured to the pairs of cutters, one of the arms resting against the end of the flue, and the other arms bearing on the mandrel. The circle of cutters is slid along the grooves to the smaller end of the mandrel, and is then inserted into the flue until the arms come against the end of the flue. If the end of the mandrel be then struck with a hammer, its tapering body will separate the cutters and force them through the flue.

In Fig. 4 is shown a flue-cutter in which a rotary cutting tool is automatically fed outward to deepen the cut. A hollow mandrel is fitted into a casing, and bears at its rear end in a bushing adapted to the size of the flue. The cutter is dovetailed into a cutter block, which moves in a rectangular cross-groove in the end of the mandrel, the block being retained in the groove by means of a cap which is screwed to the mandrel. A cutter-feeding bar, having a screw-thread on its forward end, is inclined at its rear end and passes through an opening in the cutter block, so that a longitudinal movement of the feeding bar in the mandrel will project the cutter, more or less, toward the flue. A spring-pressed pin in the casing engages a groove in the mandrel, to prevent longitudinal movement. In a socket in the mandrel is a nut for the feeding bar, on which is keyed a gear wheel. A slightly larger wheel is keyed on the mandrel, and these gears are driven by pinions on a crank shaft mounted in a bushing which is bolted to the casing. The gears are so proportioned that the nut turns slightly faster than the mandrel, and thus slowly moves the cutter-feeding bar. A screw in the mandrel keeps the nut in place, by engaging a groove therein. The pinion for the nut is secured to its shaft by a screw, and when it is desired to return the cutter, this screw is loosened and the nut is rapidly revolved by a crank on its gear wheel. The flue-cutter is secured to the boiler by means of a lever whose forked end rests on a flange on the casing, its other end resting against the flue plate of the boiler. A bolt passes through the lever and to a cross-bar at the other end of the boiler.

A cutter using rolling disks for cutting, is illustrated in Fig. 5. The parts are all mounted on a shaft which turns freely in a cylindrical block, which fits in the flue. A head having three radial slots is fitted on the shaft to turn with it, three levers carrying cutting rollers being mounted in the slots. The forward ends of the levers carry anti-friction rollers, which are engaged by a conical surface formed in a sleeve which slides on the shaft, the action being to throw the cutters out against the flue. A nut traveling on a thread on the shaft, serves to feed the sleeve on the shaft. A crank is keyed on the end of the shaft to turn it. The crank hub rests against an adjustable arm, whose other end bears on the boiler, to keep the cutters in a fixed position longitudinally.

An ingenious means for fastening a flue cutter in place, is shown in connection with the cutter illustrated in Fig. 6. The moving parts of the cutter are supported by a yoke which straddles the flue opening. A plate which overlies an adjacent flue opening, is secured to the yoke by having a screw formed thereon and screwed into an opening in the yoke. A short shaft, having its outer end square, and having an elliptical head on its outer end, is mounted in this plate. Two segment-shaped blocks are jammed against the interior surface of the flue by turning the elliptical head. The blocks are held in place by screws which pass through slots in the plate. A screw-threaded bolt passes through the yoke, and has mounted upon it a cutter carrier (through a slot in which projects the tool) and a conical feed block. The T-shaped head of the cutter rides in an undercut groove in the conical surface of the feed block. The feed block is moved longitudinally by turning a nut on the bolt outside the yoke. The cutter carrier is turned by means of a hand-spike, which is inserted in holes in the carrier.

The flue-cutter shown in Fig. 7 operates on the flue by means of four pivoted cutters, each having a series of teeth, the cutters being forced against the flue by a cam wheel. The cutters are pivoted in transverse slots in the end of a hollow mandrel, the latter being turned by means of a hand-lever operating a pawl, which engages a ratchet on the mandrel. Within the mandrel is a stem having a star-shaped wheel, which engages lugs on the cutters to force them out against the flue. The stem has a head carrying a pawl, which engages a ratchet on the mandrel to hold the cam wheel, the head having holes for the insertion of a hand-spike to turn it. The mandrel turns in a sleeve which has three levers mounted in ears upon it, the rear ends of the levers engaging the inside of the flue to hold the sleeve stationary, and the forward ends of the levers being engaged by a conical surface on a collar which is threaded on the mandrel, and by which the levers are spread.

A flue-cutter which is similar in principle to that last described, but in which cutting wheels or disks are used, is illustrated in Fig. 8. The mandrel is rotated by a hand-lever, and carries at its inner end two pivoted arms provided with cutting wheels, the pivots of the arms being connected by a cross-plate. Within the mandrel is a stem which bears in the cross-plate, and which carries an elliptical cam which acts on the arms to force the cutters outward. The stem has on its outer end a worm-wheel, which is engaged by a worm on a shaft which carries a pair of hand-wheels. The mandrel is centered by means of a triangular plate through which it passes, and which carries set screws to bear on the outer end of the flue. The mandrel turns in a collar which is adjustably clamped on a bar, to which is clamped a bar whose inner end is adapted for fastening to a tube expander, by which it may be secured in an adjacent flue.

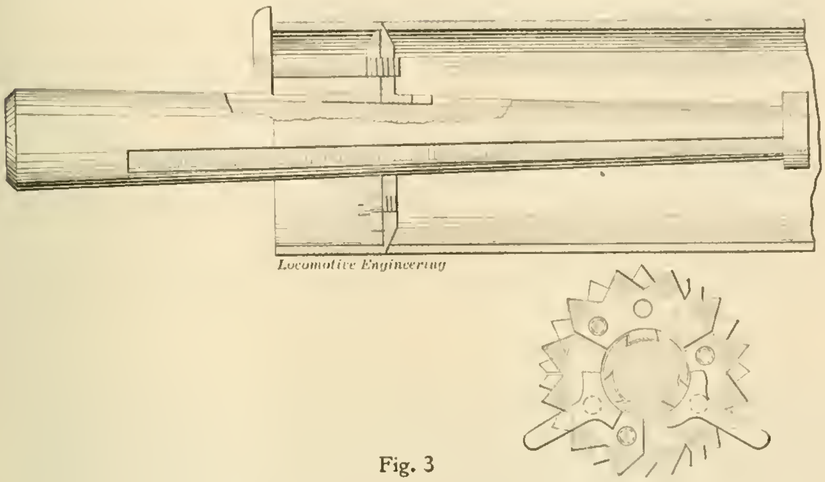


Fig. 3
CUTTERS SLIDING ON TAPERING MANDRELS.

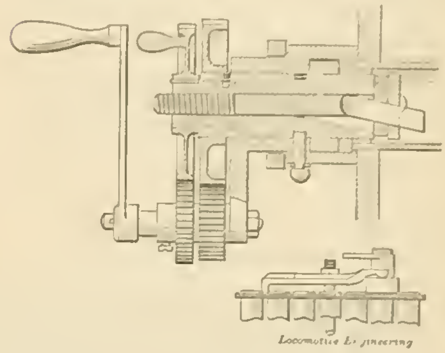


Fig. 4
REVOLVING CUTTER AUTOMATICALLY FED.

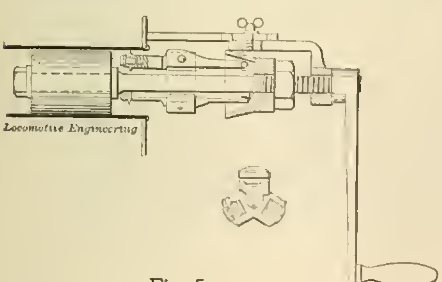


Fig. 5
CUTTING DISKS ON LEVERS.

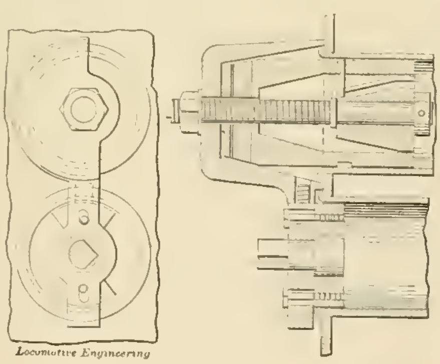


Fig. 6
FLUE-CUTTER SECURED BY EXPANDER JAMMED IN NEIGHBORING FLUE.

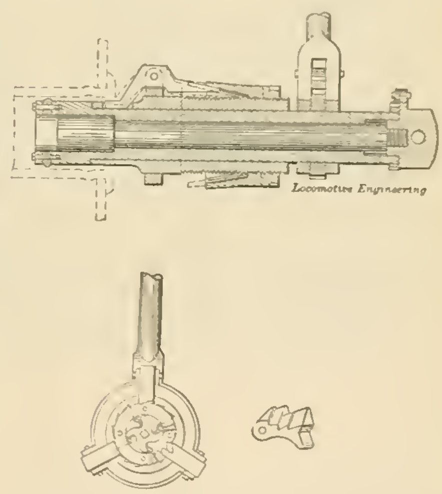


Fig. 7
FOUR PIVOTED TOOTHED CUTTERS EXPANDED BY CAM WHEEL.

There is a class of flue-cutters which make a series of longitudinal cuts in the end of the flue, after which the tongues or splinters thus formed are bent toward the axis of the flue, thus destroying the expanded portion and allowing the withdrawal of the flue. A cutter of this type is illustrated in Fig. 9. Three cutting wheels are mounted in blocks which are movable in radial slots in a stock, the latter being reciprocated in the mouth of the flue. The cutter blocks rest on a conical surface formed on a stem which is threaded in a central bore in the stock, and they are held against the stem by springs secured to the stock. The stem is turned by a hand-spike to feed it forward and drive out the cutters, and it is locked in place by jam nuts. The stock slides in a casing, against whose outer end rests the hub of a hand-lever. Both the casing and the hub have flanges on their adjacent ends, and these are united by a sectional collar which fits over them. The stock has spiral grooves in its surface, and the hub of the hand-lever has pins which engage these grooves, so that the stock may be reciprocated by a movement back and forth of the hand-lever. The casing projects into the flue, and has at this point inclined dovetail grooves, in which are fitted gripping blocks having teeth on their outer edges to engage the surface of the flue. The gripping blocks have lugs on their outer ends which engage a

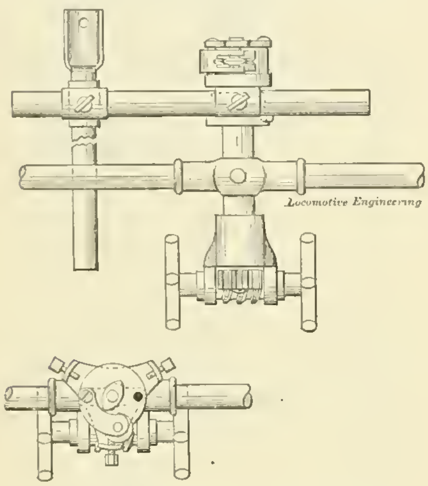


Fig. 8. PIVOTED ARMS CARRYING CUTTING WHEELS AND THROWN OUT BY A CAM.

groove in a sleeve which is threaded on the casing, and by which the blocks are moved up the inclined grooves to force them out against the flue and secure the casing in place. The sleeve has handles on it for use in turning it, and it is extended over the sectional collar to keep its parts in place.

E. J. PRINDLE.

Washington, D. C.

Cause of Leaky Tubes.

Editors:

The writer is convinced, by observation, that a great deal of the grief incident to engines with extension front ends not steaming, is that in a great many cases there is too much front end, ditto stack, for the size of cylinders. In taking charge of the locomotive department of this road I found a 15 x 22 Rogers engine with an extension front and a stack 62 inches, with 17 inches inside diameter; by reducing the stack to 38 inches in hight and putting an inside lining reducing the inside diameter to 13 inches, the engine has done better and looks better. Have also been following up leaky tubes and staybolts. I believe a great deal of this trouble can be traced to the careless use of the blower, both by ignorant engine crews and hostlers. Engineers are not blameless, where they allow firemen to use the blower too strong, while cleaning fires or ash pans. It is not an uncommon thing to see engines brought in with everything tight, and when put in the house the tubes are leaking. This whole trouble is brought about by putting the engine over a cold, damp ash-pit and allowing her to stand there, with the blower on, until the fire is knocked out and ash pan cleaned, after which she is placed over a damp, cold pit

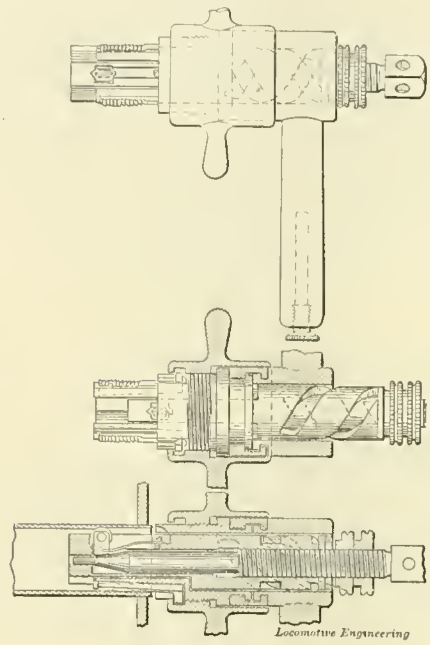


Fig. 9
FLUE-CUTTER FORMING LONGITUDINAL CUTS.

in the roundhouse, and left standing with the dampers open. Yet in the face of all this, it is a mystery to a great many, why tubes leak. The reckless use of the blower is not getting the attention it demands, on the part of those in command.

Our engines here have to stand out on the termination of their runs; and as a protection to the tubes, I have covers made to be placed on top of the stacks, after the fire is knocked out. The effect of these covers is a prolonging of the temperature in the fire boxes and tubes.

I find another cause of leaking tubes is in not breaking lump coal fine enough to prevent the passage of cold air through the fire.

W. DE SANNO,
M. M., C. & S. E. R. R.

Lebanon, Ind.

To Prevent Priming.

Editors:

I noticed in March issue letter from Mr. W. Savigny asking for a way to prevent engine from priming when the boiler is dirty or when using salty or alkaline water. To an engine in such a condition it will be of great advantage to frequently use the crown washer if the engine is equipped with one; also using the blow-off cock daily. And it will be found that an engine can make twice the mileage to a wash-out that they usually do, where these are not used. This is a matter that should be of interest to every engineman, as there is nothing more injurious to the flues and boiler than frequent washing out.

R. J. STUART.

Centralia, Ill.

Invented the Barnes Heater Eighteen Years Ago.

Editors:

Eighteen years ago I invented and put on my engine a feed-water heater precisely like Mr. Barnes', a cut and explanation of which is on page 299, April number, and have used one continually since. The one on my engine now is as much like the cut on page 299, as a photograph is like the original, except the "separator," which we do not use as we want all the oil in boiler, and the arrangement of pipes in tank, similar to what I tried, but abandoned for the simpler and better arrangement of running pipe down through top of tank near valve, to within six inches of bottom, then turn backward about three feet, using in the water 1½-inch pipe. A "pin hole" in pipe just under top of tank prevents syphoning.

Just after this Mr. Ed. Hiserodt, now of the L. E. & W. Ry., then our M. M., adopted and put this on all our passenger engines, the engineers of which, Wm. Webb, Jack Rogers, John Kiler, Zack Sharp, "Sandy" Thompson, Charles Backus, Jim Braddock, Henry Gorham, and others, all of whom are here yet, except Mr. Braddock, who is on the Wabash Ry., will substantiate what I say. We all ran into Peoria, Ill., then and used same house for engines that the Wabash did. Our road was then the I., B. & W., now Peo. Div. C., C., & St. L. or Big 4.

A. S. HAMPTON.

Indianapolis, Ind.

Small Nozzles Save Oil.

Editors:

The Traveling Engineers' Association has taken up the subject of "The operation of lubricators under high steam pressures, and other automatic appliances for oiling cylinders and valves," and I would like to state some experience with regard to the difference in size of nozzles in regard to economy of valve oil.

I was firing an engine and setting the lubricator several years ago, that had numbers of changes made on her exhaust tip from a bridge made of ⅜-inch round iron in a 4½ tip, a bushing 1-16-inch in thickness, and a bushing made out of a cellar bolt pulled into and the convex side put inside for the steam to impinge around, and the saving of oil was very much in favor of the contracted nozzle.

I have noticed it in numerous other engines where changes had been made there seemed to be a milky, oily substance that remained in contact with the inside of cylinders with the contracted nozzles that made the cylinders less susceptible to the gases sucked in by switching, or any water that would accumulate in steam passages while standing around.

It has been a question in my mind that a nozzle might be enlarged to such a size, that oily moisture that is held in suspension with a small nozzle is expelled with each exhaust and after running shut off a short distance or making a switch or two, cylinders are groaning.

I am convinced that there is a difference in the consumption of valve-oil, and while I do not favor a small nozzle, I think a small nozzle (so engine will clear herself in the 12-inch notch when running for a hill) is the most economical, especially on freight, both on the consumption of valve-oil and coal.

A. A. LINDLEY.

Oskaloosa, Ia.

SNOW PLOWING, APRIL 3, 1897, NEAR CHEYENNE, WYO., ON C., B. & Q. (From photograph sent by Engineer J. S. Willard.)

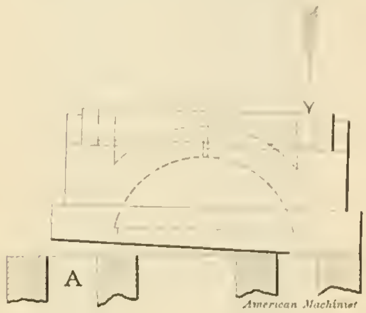
Irregular Wear of Slide Valves.

Editors:

I have for the last twenty-five years studied the wear to the valve face, as shown by Mr. Hungerford in the January number of your paper. My experience is, that the wear is due to the alternate pressure coming on each end of the valve when the port is opening during the stroke. The accompanying sketch shows the port at *A* just opening; the pressure on the valve is then as indicated by the arrow. This wear is common to all valves, more or less, and is not in any way influenced by the rocker arm. It is well known that a regulator valve is stiff before the port is open, and at once gets easy after opening, and may help to explain matters. I think Mr. Hungerford would have accounted for the wear had he placed the valve in the position now shown. It will be noted that there must be a waste of steam up the exhaust when the wear is bad.

JOHN RIEKIE,
Dist. Loco. Supt., Indian State Ry.

Sukkin Sind, India.



IRREGULAR WEAR OF VALVES.

A Condensing Steam Ram.

People who have ever found it necessary to use a syphon to raise water from creeks and ponds to fill the tanks of locomotives, are likely to be deeply interested in an air apparatus put upon the market lately by the Erwin Hydraulic Machinery Company, of Milwaukee, Wis., for the purpose of raising water from low to high levels. The invention seems to be a combination of the submerged water ram and the pulsating pump. The pressure of steam, the pressure of the atmosphere, the suction due to vacuum formed by condensed steam and the head of water are all combined to form a water-raising appliance much more efficient than the steam syphon, and less likely to get out of order. The ram is a very compact apparatus, one capable of raising 2,000 gallons of water to a hight of 30 feet, being 3 x 9 inches, weighing only 8 pounds. The capacity of the sizes made varies from 1,000 to 20,000 gallons per hour.

Railroad companies and contractors will find this a very convenient appliance to carry on construction engines. It also seems to us that its use might greatly reduce the work of pumping water at railroad water stations. All parties interested in the problem of raising water ought to try one of these rams.

Australian Water Heater.

A correspondent in Islington, South Australia, Mr. C. B. Walkington, in the course of a business letter writes us: "We just got an engine out of our shops with something new in the shape of a superheater—an arrangement fixed inside the smokebox, which heats the water after leaving the injector. I have not seen the thing so far, but outside fixed to the feed pipes are two indicators telling the heat of the water directly after leaving the injector, and the heat of the water after going through the heating process, just before entering the boiler.

"It is believed that the device saves 10 per cent. of the fuel formerly used by the engine. It is the patent of some engine driver in Victoria."

It is reported that the Morgan syndicate, of New York, has obtained virtual control of the stock of the Lehigh Valley Railroad.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

FOURTH ANNUAL CONVENTION OF THE AIR-BRAKE ASSOCIATION.

TUESDAY'S SESSION.

President M. E. McKee called to order the Fourth Annual Convention of the Association of Railroad Air-Brake Men in the hall of the House of Representatives, Nashville, Tenn., April 13th, at 9 A. M.

The first thing on the program was the address of welcome by Major J. W. Thomas, president of the Nashville, Chattanooga & St. Louis Railroad, and president of the Tennessee Centennial, who was introduced by President McKee. In an eloquent and forcible manner Major Thomas reviewed the development of the railway from the ancient Roman tramway, consisting of hewn blocks of stone, to the modern rock-ballast, 100-pound steel railway of to-day.

With surprising knowledge of the subject, the speaker followed the evolution of the air brake from its invention by George Westinghouse through the various stages of its development to the present familiar quick-action and high-speed forms. So accurate and correct were the figures of the various records and tests and the historical features of the air brake given by Major Thomas, that many of the members wondered at his unusual knowledge of air-brake details.

President McKee responded to Major Thomas' welcome, and then addressed the convention. He reviewed the work of the current year, and outlined that yet to be done. He noted that the unprecedented circulation of the reports of the proceedings had served to bring the association before railway officials, railroad clubs, and other associations in a more important and dignified light.

Eight thousand copies of the report of the Boston proceedings had been disposed of to officials and employés in all branches of the railway service, and the financial condition of the association was flattering.

After exhorting the members to active interest in the discussions, he declared the convention formally open for the transaction of business.

Motion was carried to set the hours of session from 9 A. M. to 1 P. M.

An invitation was extended to the members and ladies by J. W. Thomas, Jr., assistant general manager of the Nashville, Chattanooga & St. Louis Railway, to visit Belle Meade Farm in the afternoon. A special train was placed at their disposal. The invitation was accepted, and the thanks of the association returned to Mr. Thomas.

AIR-BRAKE MEN'S BADGE.

C. C. Farmer then read a paper on **"Air Pumps—Their Troubles and Treatment, and Tools for Making Repairs."**

The committee urged that in overhauling air pumps, the work could not be too well done, and that especial attention should be given the condition of the air cylinder.

In distinguishing normal heating from overheating valuable diagrams and tables were used. Much that is very interesting in air compression accompanied these.

The cause for overheating of air pumps, and the means for testing the condition of the air cylinders were handled in a masterly manner.

Uneven stroke, air valves sticking, lubricating air cylinder, pump stopping, pump pounding and general overhauling were sub-headings under which much valuable air-pump information was disseminated.

ADVISABLE IMPROVEMENTS.

Under this head the report says:

"All duplex pumps yet having rods pressed and riveted into steam pistons should not be allowed to pass through shops without having such changed to rods screwed and riveted into pistons, as otherwise trouble with these working loose will almost invariably result.

"The earlier pumps of this make having stuffing boxes shallower than now the standard should have these deepened.

"Centering plates on heads of same pumps should be well secured, the manufacturers' method of fastening them often resulting in their working loose, causing a sound that cannot be distinguished from that of a loose piston.

"Air pistons of all pumps should be secured by double nuts.

"One of the wrench holes in air pistons should be drilled to 7-16-inch and a device, such as illustrated, made for holding this piston when tightening or loosening nuts.

"Lower inner edges of both main valve bushings of 6-inch and 8-inch pumps should be rounded to permit of easier removal of valve that has passed too low.

"All main valves of 6-inch and 8-inch pumps should be made to conform to manufacturers' standard adopted over two years ago. Such new valves from manufacturers will be found to have the nuts and ends of main valve spindle, machine finished.

"In repairs to 6-inch pump an oil cup should be placed in top air cylinder head and at left of stuffing box. These and 8-inch pumps without should have plugs placed in lower air cylinder head to facilitate removal of reversing valve and stem on pumps without steam, and to assist in air cylinder tests.

"Reversing valve stems of all pumps with steam cylinders above should be drilled and tapped for ¼-inch bolt, that the latter, or tool illustrated, may be employed in removal of this part when necessary on road, or in round house.

"All air cylinders should be left bare to reduce as much as possible the high temperature resulting from compression. At the most, none other than a ventilated cylinder cover of netting, perforated steel or similar material, as illustrated, should be employed.

"It being an undoubted advantage to air valves and passageways to prevent oil from entering the suction openings, it is well to use on the 8-inch pump a cover for the lower suction opening."

POINTS IN REPAIRING.

Under this head the report says:

"Anneal all pump bolts and air ends of piston rods by heating to a dull red, and then placing in the lime until cool. As soon as removed from fire examine carefully for cracks, such then being easily discernible. Where heated no more than advised, scale will not form.

"In annealing the copper gaskets, if, before being heated, they are wet and sprinkled with common salt on each side, they will come out of the water almost as clean as new material.

"If, in replacing pump head bolts, only such are used as will not project through flange of cylinders, and they are first coated with a mixture of plumbago and grease, little, if any, trouble will ever be experienced in removing them.

"Make gages from unworn pumps for the following parts and use them regularly in repairing, that standards may be maintained; and when examining pumps which are giving trouble on road:

"In all instances make sure that air piston nuts are drawn firmly to prevent any looseness, as any such existing will rapidly increase.

"Do not let cylinders exceed 1-32 inch in diameter near ends (largest part) over that in center without boring.

"Don't fail to examine all reversing plates in repairing pumps, as the bottom of them almost invariably wears more rapidly than the top."

A number of valuable tools for handling air pumps and making repairs were illustrated.

A lye bath for air pumps is one of the recommendations.

DISCUSSION OF THE REPORT.

Mr. Pratt suggested the case-hardening of reversing valve plates, and claimed to have received beneficial results from following this practice. Plates of this kind had been in service some considerable time, and showed little, if any, signs of wear. Reversing plates, as ordinarily furnished, are comparatively soft, and wear very rapidly.

Mr. Bosley recommended a covering for the receiving valves of air pumps, and believed it largely prevented the clogging and stopping up of air ports and passages.

Mr. Malthaner suggested that pumps, after being repaired, be oiled and placed in an upright position, in order to prevent rusting.

Mr. Hedendahl did not believe a strainer was advantageous at the suction valves unless the valves are near the running board, and in such a position as to catch the cinders and dust.

Mr. Alex. Brown cited an instance where a 9½-inch pump had been running five years on his road, and the tool marks were yet plainly discernible in the air cylinder.

Mr. Burgess had experimented with various oils, and concluded that good results could be had from almost any high-grade oil, providing it had sufficient body. Valve oil does not always imply good oil. Some engine oils are of heavier body than some poor valve oils. Good valve oils are preferable to good engine oils for lubrication of the air cylinder of the pump.

Mr. Malthaner reported that for two years past he had not had a hot air pump on his division. His practice has been to occasionally clean and oil the steam and air cylinders of his pumps; he believes this a good practice, and claims to have obtained best results. He used high-grade engine oil in the air cylinder.

Mr. Hain has obtained good results from using valve oil in his air cylinders; he believed, however, that too much valve oil would clog the ports and passageways and stick the valves to their seats.

Mr. C. C. Farmer said, in reply to question by Mr. Conger, that plumbago, in its crude shape, is not a good lubricant for air cylinders, for the reason that the plumbago will clog and choke the passageways and ports.

Mr. Alex. Brown submitted a formula of a mixture of 10 pounds of white lead, 1 pound of black lead and a sufficient quantity of tallow as a good lubricant for air cylinders of air pumps.

The discussion was closed, the paper accepted and the committee discharged with thanks.

Proper Piping for Locomotives, Tenders and Cars.

Chairman R. H. Blackall then read the paper under the above caption.

On removing scale from pipe the paper says:

"In bending the pipe it is very essential to get the scale, and any gummy substance from the inside of the pipe. This is best done by blowing the pipe out with steam after bending. They should be blown out several times, and the pipe should, at the same time, be rapped lightly to loosen scales. If steam cannot be had air will have to do."

Further on the paper says:

"Some roads have had rather bitter experience in using a cheap pipe. It was found that in bending the pipe it splintered, the trouble being caused by steel being mixed with the iron. Best pipe is always cheaper in the end.

"After pipe is placed in position, soap suds should be applied to every joint and the pipe tested under full pressure. Listening for leaks is a very poor test and unreliable in the extreme, especially in a shop where there is noise. The use of soap suds is the only accurate method, and will easily detect leaks where a lighted torch fails.

"All pipes should be painted to prevent rusting, but the pipes on cars carrying soft coal present a very troublesome problem, and one which, if overcome, will save a great deal of money for soft coal carrying roads. Rain washing through the coal becomes saturated with properties of the coal which in striking the pipe will gradually eat a hole through them. By a continual drip a hole has, in this manner, been eaten through a new pipe in three weeks. Not only does the acid eat the pipe, but it will also eat its way into a steel rail."

Referring to the failure to get an emergency application through both engines on a double head train the report says:

"The trouble referred to when investigated proved to be caused by the improper use of too many elbows in piping the engine. Fourteen elbows, or equivalent friction in about 140 feet of extra pipe, were used. When the piping was straightened out the brakes worked properly, and proved that the many elbows produced so much friction that the suddenness of the reduction was lost before getting through the pusher engine."

Beginning with the steam pipe to the pump, the various pipes, their advantageous as well as objectionable features are systematically treated by the committee. Pipe clamps are considered important, and are treated with due consideration.

Chairman Blackall submitted samples of pipe which had been badly eaten away by the drippings of water through soft coal. He called attention to the fact that the emergency application was oftentimes destroyed by having too many bends and elbows in the train pipe. He condemned the practice of using but two pipe clamps, one on each end of the car, to support the train pipe.

Mr. Goodman related the practice employed on his road of running the exhaust pipe of the air pump through the water in the tender. The heating of water by this process, he believed, saved considerable fuel.

Mr. Brodnax has adopted the plan of turning the exhaust of the air pump into the exhaust port of the steam cylinder. There is no interference or appreciable back pressure to the pump. He recommends this practice.

Mr. C. C. Farmer finds better results from locating the pressure-reducing valve in an upright position on the main reservoir pipe near the brake valve in the cab. In this position it cannot freeze.

Mr. Hedendahl has adopted the same practice with very good results. Previous to his adoption of this practice, it was the custom to locate the reducing valve on the end of the main reservoir in a horizontal positon. The pocket thus formed would fill with water and freeze, thus destroying the operation of the valve. He cautioned members against placing the reducing valve too close to the boiler, for the reason that the heat therefrom might injure the rubber diaphragm.

Mr. Malthaner has adopted the same practice.

Discussion closed.

A resolution was introduced by the ladies present, asking that the next meeting of the association be held at Washington. However, if the delegates did not see fit to do so, the ladies pledged themselves in true caucus fashion to abide by the action of the majority.

Meeting adjourned at 1 o'clock.

At 2:30 o'clock the members and ladies were conveyed to Belle Meade on the special train tendered them at the morning session. There Gen. Jackson met the visitors, and showed them every attention. The generous Southern hospitality of the proprietor of the famous farm was in evidence, and was thoroughly appreciated by the guests. The entire party were delighted at what they saw of the resources of the farm.

On the return, the party stopped at the

Exposition grounds, where they inspected the plans and admired the magnitude of the undertaking. The visitors were warm in their praises of the prospects for the Centennial.

Late in the afternoon the party returned to their hotels, wearied in body, but well satisfied with the work of the afternoon.

WEDNESDAY'S SESSION.

Roundhouse Tests of Air Brakes on Locomotives and Tenders.

Chairman R. C. Cory read the above-captioned paper, from which extracts are made as follows:

"Air pump. In testing air-brake equipment on engines and tenders the boiler pressure should not be less than 125 pounds.

"After 60 or 70 pounds air pressure has been accumulated in the main reservoir, the pump should be adjusted to a moderate speed, but not excessively slow. It should then be determined at suction openings, whether the air is drawn in to the completion of each stroke. The nearer the approach to this the more perfect is the condition of the air cylinder.

"To locate trouble where suction is not good, stop the pump, open oil cup, and note whether air blows out of cup. If this occurs it indicates leakage back from the main reservoir. To determine this, stop the pump, and if the latter is the case the blow will continue after the piston has come to rest. Where bottom head has a plug, by removing the plug will indicate whether back leakage is taking place into lower end of cylinder. Or, when it is impossible, with a piece of wire lift the lower receiving valve; this will render unnecessary the removal of the plug.

"If the suction is poor on the up stroke of the piston, and there is no blow at oil cup on downward stroke, it is safe to assume that back leakage into the lower end is occurring, supposing of course, that air valves are not sticking. Where leakage is occurring from main reservoir back into the cylinder, it may be due either to leaky discharge valves, or on account of air passing around bushings. Practice will enable this being much quicker done than told.

"In testing the pump, it should be determined that piston rod packing is in good condition.

"Where a pump seems to run too slow or blow bad, try it with the exhaust pipe disconnected, using a short piece of pipe bent so as to turn the steam away from the jacket. This will indicate any obstruction in the exhaust pipe, absence of or a defective dry pipe, and will demonstrate and assist in locating any blow in the steam cylinder.

"A brake cylinder to be in good condition should not indicate a decrease in pressure of more than 5 pounds in 5 minutes. Should gage show a decrease of more than 5 pounds in 5 minutes it may be due to leaks in pipe connections, packing leathers, piston rod packing, or a leaking gasket between cylinder and head.

"To determine the condition of brake cylinder, a test gage should be attached once a month to cylinder pressure. As some brake cylinders are so located as to make it impossible to connect air gage to head, a tee should be placed in a convenient place in pipe leading to brake cylinder.

"Should any repairs be necessary, it is desirable that signal valve be sent to general repair shop, thereby insuring the proper adjustment and arrangement of its structural parts.

"The parts of one valve should never be exchanged for those of another; it being better to replace defective valve with one in perfect order.

"The following was recommended by the committee:

"1st. That the air brake and signal apparatus on locomotives and tenders be tested daily.

"2d. That tests be made by a man detailed for that purpose, who should be capable of making such repairs as are necessary in roundhouse.

"3d. That a report of the condition of 'Air-Brake Equipment on Locomotives and Tenders' be sent to the proper authority at least once a month.

"4th. That inspector be furnished with all such complete parts of brake apparatus as are subject to defects; which will allow the necessary changes to be made."

Mr. Hedendahl regarded the rule of two to four inches, which is usually recommended for piston travel on driver brakes, to be unreliable.

In reply to a question from a member, Mr. Pratt answered that the lower suction valves in the air pump break easier than the upper valves, because the cooling of the lower valves is more rapid than that of the upper.

Mr. Brodnax believed that the test recommended by the committee, of requiring the pressure in the brake cylinder not to leak away any faster than five pounds in five minutes, was too severe.

Mr. Hain has followed the practice of attaching the air gage to the driver brake cylinder for three years past. He reports excellent results.

Mr. Kidder believes that the past tests of air gages have been sadly neglected, and that some plan should be adopted to obtain a better adjustment of the air gage.

Mr. Nellis submitted a plan for testing the efficiency of the air pump by number of strokes, the capacity of the air cylinder of the air pump and the capacity of the main reservoir being known.

Mr. F. B. Farmer suggested that the rule for driver-brake piston travel be changed to read no less than one-third and no more than two-thirds on the stroke, instead of no less than two inches or more than four.

Discussion closed. Report adopted.

Best Location for the Air Gage Where It Can Be Seen by Night and Day.

Chairman C. P. Cass then read the above captioned paper, extracts from which are as follows:

"In consequence of a failure to realize its importance the air gage has been located in all sorts of out of the way places, and in some cases has been so placed that it is almost impossible to read it in broad daylight, and at night it is entirely lost. To this may be traced, in many cases, the rough handling of trains.

"Smooth and safe braking can be secured in a greater number of cases where the gage is so located that the pressures at the beginning of the application and during the several reductions can be easily read.

"Next in importance to a good location for the air gage is that it be well lighted at night. A great many different styles of cab lamps are in use, as almost every road has a standard of its own; some using the more expensive hooded lamp, others use the same lamp without the hood and paint the interior of the globe, leaving a clear space for the light to shine through on the gages; others use a regular lantern globe with the bottom hoop and oil pot, also painting the interior of the globe, the latter being the general practice.

"Air gages on locomotives should be so attached as to bring the pipe connections pointing directly down, and not rolled over to one side to accommodate crooked piping, as the location of piping is of secondary importance.

"The pertinent question has been asked: 'If 70 pounds is the standard train line pressure, why is this not better indicated by, say, a heavy cross red line at that point?' We read a gage as we do a watch, not so much by figures as by the angle of the hands. Any unusual position taken by the pointers will be quickly noted by the observing engineman, and he will at once take steps to remedy the trouble the silent monitor brings to his notice.

"The air gage on all brackets should be placed to the right of the steam gage, never to the left or above it, as is quite frequently done. The flange of the stand to which the air gage is to be attached should be at such an angle as to bring the dial of the gage to squarely face the engineer.

"Wherever possible, the gage should be located so that it is about the height of the engineer's eye when in his place on his engine, and so near his line of vision when looking ahead that he can glance at it without turning too much to one side.

"We would suggest to manufacturers that the style of air gage front be changed somewhat, so as to avoid as much as possible the shadow of the rim on the dial when the lamp is at one side.

"In selecting a standard location for air gages, the influence of heat conducted through the gage bracket and radiated from the boiler, combination stand and injector pipes and valves, should not be overlooked, as the metal parts of the interior of the gage, like all other articles of metal, are subject to the laws of expansion and contraction from heat and cold, which makes it necessary at all times to keep the gage as cool as possible to prevent unnecessary expansion of its interior mechanism, thereby preventing a false indication of pressure. It is believed the gage would not be appreciably affected by any difference in the temperature.

"Opinions differ among air-brake men as to the best style of gage face; a great many favor the silvered dial with black and red standard colors for gage pointers. The black dial with white train line pointer and numerals possesses the advantage of doing away with the possibility of mistaking the shadow of the train line pointer for the hand itself; this effect being had where the cab light is dim and placed at the left and a little below the air gage. It might also be stated that the reflection of light into the engineer's face from the dial of this type of gage is practically done away with."

Mr. Cass had previously believed that a position directly ahead of the engineer was the proper location for the air gage; but recently he had come to the conclusion that such a location was not a good one for the reason that it would be unwise to remove it from the group of gages away from the fireman's vision. He recommended that a small rim, like that used on test gages, be used on the air gage. The rim as it now is projects too far and forms a shadow which, when thrown on the face of the gage, makes it extremely difficult to read the figures. He stated that a communication had been received from a member too late to incorporate in his paper. This member had advanced a new scheme for locating the numerals on the dial. He believed that a smoother handling of trains would be made if the engineers were in closer communication with the air gage.

Mr. C. C. Farmer had noticed that the red hand was next to the face of the gage, and that the black end was furthest away. This arrangement of hands permitted a shadow to be cast which was liable to mislead the engineer, and cause him to believe that the pressure registered by the shadow of the black hand was a true one.

Mr. Alex. Brown gave good reports of the style of air gage having two pointers traveling in an opposite direction. He believed this style of gage equal to the ordinary duplex style with both hands traveling in the same direction as the hands of a watch. He thought it merely a matter of the engineer getting accustomed to it.

Mr. Hutchins believed that the reading of the air gage was one of the most important items in good air-brake operation. His observation had been that about 80 per cent. of the air-brake gages were not readable after night on account of their obscure location.

Mr. W. I. Steele expressed a belief that the air gage is equally valuable to the engineer as a clock to a train dispatcher.

Mr. Malthaner applied air gages in a manner to avoid heating in the inner parts. He cited instances of improper adjustment made by bending the hands and slotting holes in a dial to make the gage register with the test gage.

Mr. Nellis says that the air gage was originally used in straight air merely as a recorder, and at that time was given any position which would get it out of the way of other fittings in the cab. Since the introduction of the automatic brake no better location nor more serviceable gage has been furnished.

Mr. Decker stated that an extra gage is used on the mountain engines of the Southern Pacific Railway. The connection is made to the train pipe below the cut-out cock at the brake valve. By this scheme the engineer, when running second, third or fourth engine, can see how the pressures are being manipulated by the engineer on the leading engine. He deprecated the use of iron pipes to the gage as these pipes were not always well fitted, and the strain would pull the tubes in such a way as to cause a false register.

Mr. Malthaner disapproved of the iron pipe as described by Mr. Decker, and recommended the use of copper pipe, which will yield to strains, and not interfere as described.

Discussion closed.

Mr. J. W. Thomas, Jr., through Mr. Otto Best, issued an invitation to the members to attend an excursion to Lookout Mountain, and requested that all members desiring to make the trip would properly inform him, that he might obtain for them the proper transportation.

Shop Tests for Triple Valves.

Chairman Wm. Malthaner then read a paper on the above subject. Following are extracts:

"The deeper the subject is investigated, the more apparent it will be that repairs to triple valves, other than the very simplest, should be taken from the hands of the car inspectors, or repairers, who have not had the special mechanical training necessary for the proper performance of this work, and placed under a limited number of men, the number being only sufficient to perform the work for the entire system.

"It is folly to place a repairman in a location where dust, much noise or a poor light must be contended with, and then expect good results. Dust prevents accuracy in fitting slide valve and piston packing ring; noise renders difficult the detection of leaks, and a poor light increases the requisite time for performing all the work.

"Before applying new gaskets be sure that the parts they come in contact with are clean and smooth. By using graphite on the gaskets and on the surfaces where the gaskets bear, there will be no trouble from their sticking and being destroyed in removing.

"A triple piston-packing ring should never be removed, except it is to be destroyed. There is no necessity for doing so if it is still fit for service; further, if it is taken out and replaced it will not fit as well as before. These reasons are sufficient, irrespective of the likelihood of the ring being broken by the operation.

The conclusions and recommendations which the committee has drawn from the foregoing are as follows:

"1st. That triple valve repairs be made at as few places as possible, and by men of known capability.

"2d. To enable this to be done, that outside repair points be furnished with a sufficient number of good order valves to permit of necessary changes being made.

"3d. That no repair parts be furnished such places except bolts, rubber gaskets and emergency valves.

"4th. That before shipping triple valves, the openings into same be plugged so as to exclude all dirt.

"5th. That a test rack and necessary tools be provided for the general repair point or points.

"6th. That means be provided on test rack for causing a gradual but steady rise in train-pipe pressure, and that all repaired valves be given a thorough trial to guard against packing-ring leakage, this being very important.

"7th. That a set of gages be made and used to guard against deviation from standards.

"8th. That strict rules be issued prohibiting the removal of triple piston packing rings, except same are to be destroyed.

"9th. That in the opinion of the committee, if the manufacturers find it necessary to grind cylinders for main triple piston to secure necessary accuracy, then boring these cylinders in repairing is inadvisable.

"10th. That the hose should be properly hung up in the coupling hooks when not in use, and if the present hook manufactured, or place of attaching it to car be unsatisfactory, that the agitation be in favor of a betterment of these features instead of dispensing with it, as in the opinion of the committee the wear of the several working parts of the triple valve is materially increased by the dirt gaining entrance to the air-brake system by hose dragging."

Mr. Cope described the methods employed by the W. A. B. Co. to fit rings in triple valve pistons.

Mr. Kidder objected to the method of enlarging the groove in the triple piston in order to accommodate the entrance of a new ring. He thought the ring should be reduced to fit, and the standard width of groove be preserved.

Mr. Malthaner recommended that supply parts for triple valves be bought from the manufacturer of that particular form of triple valves, as he had observed that different companies were selling supply parts alleged to fit various forms of triple valves.

Mr. Burgess advised repairmen to provide themselves with hardened steel gages made to fit the ring and the groove, and to preserve the standard width and thickness.

Mr. Cope, in response to a question from a member, said that when a packing ring was removed from the groove in a triple valve it should never be replaced. All rings placed in triple valve pistons should be ground into their cylinders. He replied, in response to a question from Mr. Kidder, that the wear of the ring and groove is not considerable.

Mr. Huntly grinds the rings down to fit the groove and keeps the groove standard size.

Mr. Decker observed that rings have been in triple pistons on the Southern Pacific for fifteen years without renewal or repair, and are still running.

Mr. Hedendahl did not believe that the wear of the ring in the groove was appreciable to any considerable extent. He had observed that the rings of old freight triples which had been in service for many years past on his line were still in very good condition.

Mr. Nellis gave an instance of emery having been placed on the seat by a repairman, in order that it could grind the valve to its seat while running in service.

Mr. Bannon thought that the fourway cock could advantageously be removed from the plain triple valve, inasmuch as the handle on recent make of valve is so constructed that it cannot be thrown from the automatic position.

Mr. Cope informed the members that ground glass was used by the W. A. B. Co. to grind the parts in the triple valve.

Mr. Smith had used pumice stone with good results for grinding new slide valves in a triple.

Mr. Daly considered the fourway cock a detriment, inasmuch as it gave trouble from leakage, and recommended its removal.

Mr. Best objected to the use of emery as advised by the committee, and recommended the use of ground glass in its stead. Several members indorsed the recommendations.

Discussion closed.

At 3.00 P. M. a special train, provided by Assistant General Manager J. W. Thomas, Jr., carried the members and their ladies on an inspection tour of the N. C. & St. L. Ry. shops, and the several switch and signal plants equipped with the Thomas pneumatic interlocking device.

Competent judges pronounced the shops the most modern in the country. The surprising speed and accuracy with which the switches and signals are operated, and the seeming infallibility of the apparatus, speaks eloquently of the energy and genius of the man who, while giving personal direction to the operation of a thousand miles of railroad, finds time to invent, devise and develop a purely pneumatic system which rivals the speed of electricity in long distance work and exceeds it in short distances.

THURSDAY'S SESSION.

Secretary Kilroy read his report. At the end of the fiscal year there was $1,313.35; at the present time there is $1,593.35 in the treasury, and all bills paid.

Chairman W. I. Steele then read a paper on

The Pressure Retaining Valve and Its Uses.

The paper treated in a historical way the evolution of the retaining valve. The recommendations of the committee are as follows:

"On grades sufficiently heavy for the use of retaining valves, would recommend them on all cars in the train, regardless of whether the cars are loaded or empty. When necessary to use only a portion of the valves, those on the head cars should be used.

"Trainmen and conductors should always be instructed to turn up the number of retainers that the engineer wants, and not what they themselves consider sufficient.

"In order to make the retaining valve an efficient device at all times, it is necessary that the brake-cylinder packing be in good condition, pipe to valve tight, and seat of valve clean and true.

"The percentage of grade on which a train can be handled without the use of retainers cannot be definitely specified. Some engineers are much more skillful than others; circumstances of the condition of the brake, curves of the road, etc., have to be taken into consideration. As the retaining valve is a portion of the equipment which can be used at will, its use must be left discretionary with the men handling the train.

"On engines the retainer should be located in the cab on the right side within easy reach of the engineer. On tender, on left side near the top of the tank, just in rear of the grab-iron.

"It is the consensus of opinion that the weighted valve adjusted to retain 15 pounds, with a ⅜-inch opening for full release, and 1-16-inch opening when the valve is in operation, is better adapted to meet all requirements than any other form of valve that has come under the observation of your committee."

Mr. Goodman said that a number of the locomotives on the Northern Pacific Railway were equipped with retaining valves on the drivers and tender, but as yet the service had been so limited that he could not furnish any important data. He believed in the practice to a certain extent, but preferred to wait for further developments before discussing the matter further.

Mr. Decker thought especial attention should be given the retaining valve by trainmen on both freight and passenger trains. On the Southern Pacific grades all retaining valves are used.

Mr. Hedendahl stated that on the heavy grades of the Union Pacific road all retaining valves were used. On gentle grades only a certain proportion as were necessary to hold the train were used.

A member asked if it would not be advisable to change the size and shape of the port in the retaining valve, to prevent the entrance of insects which build their nests therein to the detriment of the operation of the brake.

Mr. F. B. Farmer believed that the ailment as cited by the member did not exist to a sufficient degree to warrant any change in the construction of the valve.

Mr. John A. Hill expressed a belief that the retaining valve could be advantageously used to hold the slack of the train bunched at water tanks and other accurate stops.

Mr. Fredericks stated that in the Baltimore tunnel brakemen were accustomed to use several retaining valves on the head end of long freight trains to hold the slack bunched.

Mr. Sherwood said it was the practice with his division on the Northern Pacific Railway to use all retaining valves on heavy grades.

Mr. Frazier thought that the number of retaining valves to be used should be dictated by the engineer, except on heavy grades, where all valves should be used.

Mr. Nellis thought the use of retaining valves on engines and tenders would be advantageous to assist in making accurate stops by holding the slack of the train bunched, and asked the members to make experiments and note results.

The discussion was closed and paper accepted.

The report of the Auditing Committee was presented and accepted.

Chairman W. H. Durant then read the report of the committee on

Foundation Brake Gear for Locomotive Tenders.

The paper was complete. It began with the early and defective forms and gradually proceeded to the latest and best type. The paper was well illustrated. Following are extracts from the paper:

"Electricians would be blind, indeed, to install expensive and efficient dynamos in a generating plant, and then provide a faulty system of transmission by which the electric energy would be almost or totally lost before reaching the destination where it was intended to serve a useful purpose. The generators may possess a high efficiency, the motors may be equally efficient, and the lamp circuit may be practically perfect, but the plant will be an expensive failure if the means of transmission is faulty to the degree mentioned.

"The above cited faulty system of electric transmission of energy has an analogy in the process frequently employed in applying air brakes to locomotive tenders.

"Lost travel is one of the deadliest enemies to effective brakes.

"A strong, rigid metallic brake beam is manifestly preferable to any form of wooden beam; but a well-trussed wooden beam is certainly more desirable than a poor metallic beam. The name "metallic" does not always imply superiority over a wooden beam. A successful metallic beam is one whose deflection under a maximum load is not considerable, and one which will withstand the hard knocks of service.

"Perhaps the better way to determine the real value of the various metallic beams is to observe which type most largely contributes to the scrap heap.

"It can be safely said that greater freedom from slid flat wheels is had under tenders than under cars, and is principally due to the fact that the load carried by the tender is greater in proportion to the weight braked than any vehicle in the train. Another reason is because the foundation brake gear on many tenders forms such a faulty medium for transmission of power from the piston to the brake shoes, that it is impossible to obtain but a very modest brake force, to say nothing of the much higher force required to skid the wheels.

"It is a conviction of the committee that almost the entire number of slid flat wheels removed from locomotive tenders can be traced to faultily constructed foundation brake gear."

Mr. Kidder complimented the committee on its able report, and urged that every air-brake man should bring the paper to the notice of those officials having under them the equipment of tenders with brakes.

Mr. Hutchins stated that many draftsmen equipping locomotive tenders with brakes were accustomed to figure the leverage in an erroneous fashion, which gave undue pressures.

Mr. Durant cited an instance of where a short coupling at the rear of the tender had caused the rear of the tender to be lifted to a degree which relieved the rear truck of some of the weight it usually carried, and flat wheels resulted.

Mr. Dow stated that he had made extensive experiments with high total leverage on tenders, and was somewhat surprised to find that as high as 14.6 could be advantageously used where the brake shoes were hung about 13 inches from the rail. He also believed that 100 per cent. of the light weight of the tender should be used as braking force.

Mr. Pratt believed that 100 per cent. brake power could be safely employed. He had observed that on a certain tender on his road a steam brake had been applied which braked to 123 per cent. of the light weight of the tender with no bad results.

Mr. Kidder urged that an especial care be taken in selecting brake beams, and cited an instance where wooden beams had been double trussed and gave almost as much deflection as the plain beam.

Mr. Conger has been employing 100 per cent. brake power for the last five years, and all tenders on his road are equipped with brake gears of the equalized form.

Discussion was closed, report accepted and committee discharged with thanks.

The roll was then called, and 108 members were present.

CHESAPEAKE & OHIO AIR-BRAKE INSTRUCTION CAR.

The Committee on Thanks submitted their report, and voted especial thanks to the railroad companies for their kindness in providing members with proper transportation to attend the Nashville Convention. Especial thanks were tendered to J. W. Thomas, Jr., Assistant Manager of the N. C. & St. Louis Ry.

The report was accepted and the committee discharged.

The paper on signals which had been placed on trial for a year at the Boston Convention, was rejected.

After considerable discussion on the question of the Air-Brake Association and the Traveling Engineers' Association becoming more closely allied and meeting at the same place, one closely following the other, the proposition was made that the Traveling Engineers should change their time of meeting to that of the Air-Brake Men, and that the latter should be permitted to meet first.

Baltimore was selected for the next meeting. The election of officers was as follows:

President, M. E. McKee; First Vice-President, W. F. Brodnax; Second Vice-President, R. H. Blackall; Third Vice-President, T. A. Hedendahl. Executive Committee—E. W. Pratt, Robert Cory, I. H. Brown. The Press and Printing Committee was appointed as follows: S. D. Hutchins, W. F. Brodnax, F. B. Farmer.

The convention then adjourned.

A tally-ho trip, which had been arranged in the morning for the ladies, brought up at the capitol at 1 o'clock sharp, and a group photograph of the members and ladies, on the south steps of the capitol, was taken.

At 3.30 P. M. two special coaches were attached to the regular train, carrying more than one hundred air-brake excursionists to Chattanooga. Arriving at 9.30 P. M., the members found arrangements made for their accommodation at the Read Hotel.

After an early breakfast the party was taken by carriages and tally-ho's to the National Cemetery, Missionary Ridge and Chickamauga battlefield. Up the almost perpendicular incline plane the excursionists proceeded to the battleground on Lookout Mountain. Arriving at the top, a most beautiful panorama, and one worth traveling many miles to see, was presented to the pleased and appreciative party.

After a hurried dinner, the two special coaches containing the excursionists were attached to the regular train at 1.30 P. M., and the party returned to Nashville, from where they dispersed for their homes—some to the Pacific coast States, some to the Atlantic coast States, some to the States on the Mexican Gulf coast, some to the shores of the Great Lakes—and the vote was unanimous, that the Fourth Annual Convention of the Air-Brake Association had been a success, both in a business and social way.

C. & O. Instruction Car.

Editors:

The subject of air-brake instruction is a very live one down this way. The officials of our roads spare no pains to make it successful. In order to do the work in as systematic a manner as possible, there has just been completed and placed in service an instruction car that we consider one of the best in the country. It is not as large nor as elaborate as some instruction cars, but is arranged in what we consider the best serviceable manner.

The car was built at the Richmond shops of this company, under the personal supervision of Mr. Morris, S. M. P., and Mr. Lloyd, M. M., who spared no pains to make the car an efficient one in every way. It is 50 feet long over sills, and has the standard passenger-car framing, with the addition of solid trussing below the belt rail. The space in between trusses is filled in with pine blocking, glued and screwed solid.

In the arrangement of the brake apparatus inside of the car, the general plan of the Southern instruction car was followed, but such points as we feared might prove weak were strengthened. The sixteen freight brakes are fastened to the two sides of the car, eight on each side, by a rack which may be described as a half of the usual rack found in a number of instruction cars. Three uprights of T-iron are fastened to the framing of the car at the top by lag screws, and to feet at the bottom, which latter are bolted through to clamps across the sills. Horizontal pieces of ⅝ x 3 inch flat iron are used to secure the brakes to. On one side of the car, between the first freight brake and the main reservoir, are the usual driver, tender and passenger-car brakes, with straps from the cylinder heads by which the travel may be adjusted to any given point. The sectional plain triple is operated in tandem with the driver-brake triple.

On the opposite side of the car are the sectional quick-action triple, brake valve, governor, signal valves, air pump, and a sectional Monitor injector and Nathan double feed lubricator, on which instructions are given after the regular air brake instruction.

The pipe work for the freight train is all under the floor, and is left uncovered that we may be able to get at it in case of a leak. The pipe work for the signal line, overhead, is a duplicate of the train line, only on a smaller scale. We have the full 40 feet length of pipe for each freight car, and very close to 60 feet for each passenger car.

C. & O. INSTRUCTION CAR.

The boiler which supplies the power for operating the air pump and heating the car is of the upright tubular type, and was built for the car by Mr. Lloyd. It more than supplies the amount of steam required. It is fed by a Nathan automatic No. 36 injector, which is eminently suited to the work. The coal bin is on the right and the water tank on the left of the door as the car is entered. The water tank carries an ample supply for three days.

Entering at the machinery end of the car, the boiler will be noticed occupying a position immediately over the center plate of the truck, with the coal bin and water tank as mentioned. Passing around the boiler to the left, we see the view presented in photograph No. 1. The view No. 2 is looking from the same end of the car, from the opposite side of the boiler. No. 3 is looking from the door between the office and instruction room in the direction of the boiler, showing the water tank on the right side of the picture and the coal bin on the left.

At the other end of the car is a very comfortable office fitted up with a large double berth and desk. The usual telltale gages occupy their proper place in this end.

In addition to the apparatus mentioned, a complete working model of the Safety Car Heating and Lighting Company's standard system of car heating forms part of the equipment. Instructions are given on this to the employés having any connection with the heating of trains.

The men are admitted to the car in classes of eight or ten. The engineer's instruction starts promptly at 8 A. M. This lasts until 10, and an examination follows until about noon. The firemen are instructed and examined with their engineers, and the brakemen with their conductors in the afternoon. Special classes are arranged for the inspectors and machinists employed on air-brake work.

A certificate is issued to each man, the instructor retaining the stub, and a report is made to the superintendent and general superintendent as to each man's record. In addition to this, a separate record of each man is kept in the car, showing his first rating, his highest rating, and the number of visits he makes to the car. By this means each man's record can be seen at a glance, and it can be seen whether he is progressing, remaining stationary, or whether he is going backward.

The car, in going over the road, not only stops at the principal points, but at every point where men lie over long enough to take a course of instruction.

W. P. Huntley, Jr.,
Air-Brake Instructor, C. & O. R. R.
Richmond, Va.

Growing Interest in Air Brakes.

The importance of a thorough posting on air brakes is daily becoming more generally appreciated. Several roads have decreed that a fireman who cannot pass a satisfactory examination on air brakes shall not be an eligible candidate for promotion. Other roads require all men seeking employment in road service to pass the air-brake examination. One large road gets good results in requiring their men to pass annual examinations, and as this interesting time approaches, some tall hustling is done by those who have permitted themselves to grow rusty.

The astonishing statement is made, but borne out by facts, that the difference of one mill per ton per mile on freight carried by all railroads in the United States, makes a difference in the revenue of eighty millions of dollars. It is the careful watching of the tenth part of a cent that brings profit to the transportation companies, and it is no wonder that the holders of railway stock are anxious for some legislation which will enable them to receive some return for their investment.

Nashville Convention Items.

M. E. McKee was re-elected president.

One hundred and eight members answered roll call.

The papers read were uniformly good. Look out for the proceedings.

The Nashville convention was unanimously voted even a greater success than its predecessors.

The new association badge easily became a prime favorite. It is free to members.

The traveling engineers say "Barkis is willin'," the air-brake men are agreeable, and so it looks as though the two associations will come together next year.

The doubling of Secretary Kilroy's salary was a popular and commendable act, demanded by the rapid growth of the association and the consequent increased duties of the office.

An excellent programme for the amusement of attending members was furnished by the committee on arrangements. The credit for the pleasure trips and excursions belongs entirely to J. W. Thomas, Jr.

The new air-brake instruction car just built by the N., C. & St. L. Ry., and placed on exhibition during the convention, is generally admitted to be the best designed and one of the finest ever built.

Considerable matter has been crowded out of the air-brake department this month by the report of the proceedings of the Air-Brake Convention, at Nashville, which will appear in our next issue.

One of the most notable features of the Nashville convention was the cheerfulness and alacrity with which the railway officials granted requests of members for transportation to attend the convention.

Rumor has it that Messrs. Frazer, Hutchins and Decker refused to risk their avoirdupois in making a descent of Lookout Mountain via the steep incline plane, and that they walked down a bridle path in the rear of the mountain.

$1,313.35 is the amount reported by the secretary in the air-brake men's treasury at the end of the fiscal year. At the adjournment of the Nashville convention $280 additional was collected, making a total of $1,593.35, with all bills paid; quite a creditable showing for so young an organization.

Of the many railway officials who have been pleased to encourage the work of the Air-Brake Association, there is none held in higher admiration and esteem of the air-brake men than that compact little bundle of energy and ability which constitutes the make-up of J. W. Thomas, Jr., assistant general manager of the N., C. & St. L. Ry.

QUESTIONS AND ANSWERS

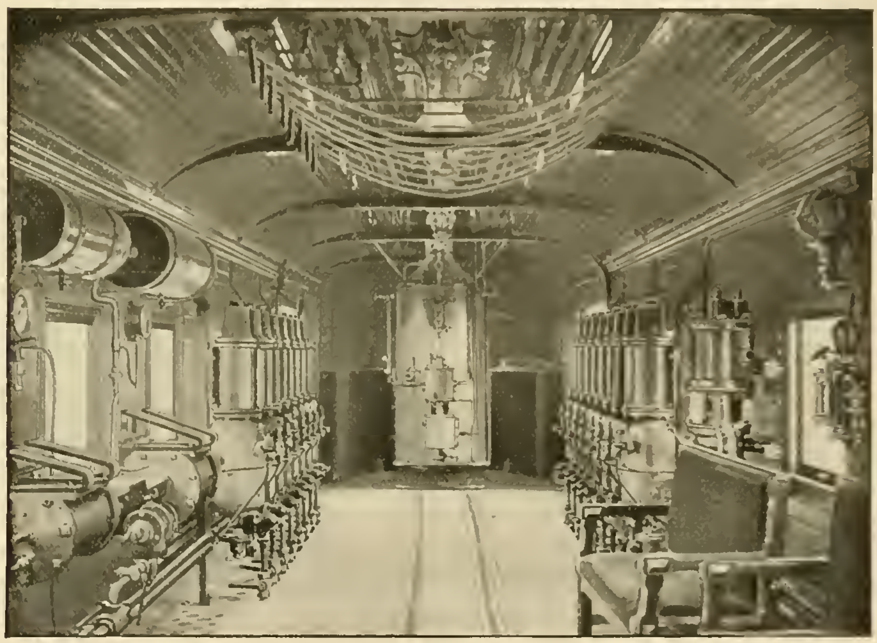
On Air Brake Subjects.

(73) J. McG., Covington, Ky., writes:

Please give a description of the "Odd" Brake and its mechanism. A.—We know of no brake of this name. Odd brakes, because of their difference from standard forms, are frequently referred to in instances where they interfere with the operation of the latter kind.

(74) E. H. G., Carlisle, Pa., asks:

Why is it that the air cylinder of the air pump sometimes gets very hot? I have heard of it acting in this manner. A.—In compressing air, heat naturally follows, unless some cooling means is employed. Unnatural heating is principally caused by restricted air passages, insufficient lift of air valves, leaky packing rings and badly worn air cylinder.



C. & O. INSTRUCTION CAR.

(75) J. P. L., Toledo, O., asks:

Are automatic air brakes used on street car lines, and if so, where? A.—We do not know where any are being used. Quite a number of straight air brakes, however, are in operation on lines having heavy trolley cars. An eccentric on the axle pumps the air, and a brake valve, operated by the motorman, admits and releases pressure from the brake cylinder. Cars on the One Hundred and Twenty-fifth Street line, New York, propelled by compressed air, have straight air brakes.

(76) L. E. B., Frankfort, Ky., asks:

Are air brakes on the engine trucks used? If not, why not? A.—Truck brakes are gradually gaining headway and becoming more generally used. Objections to their use has been made, on account of a belief that brakes on the leading truck would interfere with the engine going around curves; but inasmuch that the brake is contained on the truck, this argument is weak and without foundation. This is proven by the fact that the fastest trains in the country are equipped with engine truck brakes.

(77) F. E. M., Jacksonville, Ill., writes:

Which should be the position of the brake valve handle, running or full release, while backing a passenger train into a depot with train men handling brakes from rear end of the train? A.—Both positions are used with apparent good results. When departing from the usual method of the engineer handling the brakes, it is difficult to advise. However, safety should be the first consideration in any scheme employed, and we would therefore advise the engineer to place his valve on lap, and turn over to the train men the operation of the brakes in the instance cited.

(78) A. A. S., Buda, Ill., writes:

In regard to freight triple valve on a passenger car, as mentioned in question 47, March number, please explain how we handle twenty-five freight cars with quick-action triples and six or eight passenger coaches in the same train. The coaches are behind. We do this; but why do we not break in two. A.—Question 47 pertains to a freight triple on an auxiliary reservoir. The trouble referred to in that question is caused by putting a triple on a reservoir not adapted to it, and not to working both triples in the same train. Both freight and passenger triples are proportioned to their own auxiliary reservoirs, and will not work as advantageously when exchanged.

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Feed-Water Heaters.

There appears to be a revival at present of the inventing of feed-water heaters for locomotive purposes. This is one of the most alluring lines of invention there is, and it has drawn many victims into a net of disappointment. There is so much useful work in the shape of fire fanning for the exhaust steam of a locomotive to do that there is not so much heat to spare for the heating of feed water as there is with other engines. Those who devote their energies to devising apparatus for utilizing the heat of the exhaust steam in feed water heating generally overestimate the possible saving. Under the most favorable circumstances it is not more than 5 per cent., and that is easily eaten up by the original cost and maintenance of the apparatus.

The introduction of the feed-water injector greatly lessened the value of feed-water heaters, because care must be taken to prevent the feed water from getting too hot for being operated by the injector. The ordinary injector cannot be depended upon to work with certainty if the feed water is above 100 degrees Fahr. That leaves a very small margin for the feed-water heater to operate on. The feed water will average about 60 degrees Fahr., so that permits the feed-water heater to add about 40 heat units. A heat unit is the amount of heat required to raise one pound of water one degree at its greatest density. The amount of heat needed to increase a pound of water one degree at other temperatures does not vary materially, and so, for all practical purposes, we may regard it as constant.

Now let us take a locomotive boiler which is carrying 180 pounds gage pressure, which is about 195 absolute pressure above a vacuum, and find the amount of heat required to raise the steam to that pressure. The temperature of the boiling point under this pressure is 379.5 degrees Fahr., and that is the temperature at which the water begins to boil. The injector having delivered the feed water at a temperature of 100 degrees Fahr., 279.5 heat units must be added before the work of evaporation commences. In the evaporation of water into steam a great deal of heat has to be expended in doing the work of tearing the molecules apart, which is not shown by the temperature. The amount of heat required to convert a pound of water at the boiling point into saturated steam is called the latent heat of the steam. At an absolute pressure of 195 pounds to the square inch, the latent heat of steam per pound is 843; so that number of units must be added before the water is converted into true steam.

To reach this condition, from the feed water we have added 40 heat units, from the feed-water heater, 279.5 units more, to bring it up to the boiling point. It is really 384.7, due to the difference of heat required to raise the temperature of water one degree at the higher temperatures; but that may be ignored. Then we have 843 heat units needed to finish the work of evaporation.

The problem then stands: By the heat of the fire we have put $279.5 + 843 = 1{,}125$ heat units from the boiler into the work of steam-making and 40 heat units from the heater. By an ordinary problem of arithmetic we say, as 1,122.5 is to 40, so is 100 to the percentage of saving effected. A little figuring will show the saving in this case to be about 3½ per cent.

The invention of water heaters nearly always originates in a fallacy, or failure to understand the amount of heat that has to be expended in converting water into steam. Several inventors of feed-water heaters have argued to the writer in this way:

"We receive the feed water at a temperature of about 60 degrees Fahr., and it has to be raised to the boiling point, which is 212 degrees Fahr. Now, if I can raise the feed water 50 degrees by means of a heater, I will save about one-third of the fuel. If a heater adds only 20 degrees, it brings a gain which no railroad company can afford to ignore. Let us figure it up on the basis of putting only 40 degrees of heat into the feed water; that brings the temperature up to 100 degrees Fahr., and 112 degrees more are required to bring it to the boiling point; a total of 152 degrees is required to bring the water from tender temperature to the boiling point, and 40 degrees of that have been supplied through the heater, leaving 112 degrees to be supplied by the fire. The economical result can be readily calculated by the arithmetic problem: As 112 is to 40, so is 100 to the percentage of saving. In this case, the saving is found to be over 35 per cent."

It is needless to say that people who reason that way are too deficient in knowledge of heat problems to do anything which is likely to effect saving. Those who have studied steam engineering in merely an elementary way are aware that when the feed water has been raised to the boiling point, only about one-seventh of the heat required for total evaporation has been put into the water.

If science or invention shall ever produce a practical injector that will utilize part of the exhaust steam to operate the injector, then an important part of the heat now escaping by the exhaust steam will be returned to the boiler. An invention of that kind will produce a feed-water heater worthy of consideration. Under the present condition of locomotive operating, the injector has killed the utility of the feed-water heater; but there was very little margin of economy, even when pumps were employed as boiler feeders.

About twenty-five years ago, when feed pumps were still in use, a feed-water heater, patented by an officer of the company, was applied to a locomotive, which the writer was running. It was practically the same thing as Mr. Barnes has lately patented, and which is claimed in this issue by Mr. A. S. Hampton, and was patented in England about twenty-five years previously. Part of the exhaust steam was taken through pipes and let into the tender, and it worked so that, when the water was getting low in the tender, it would sometimes reach almost the boiling point. It was carefully operated, and every effort made to have it become a success. The engine was on a run which had practically the same weight of train day after day. After the heater had been in operation for about a month, and close attention devoted to the difference of the steaming of the engine, both fireman and engineer were compelled to admit that it seemed to make no difference. The inventor came to the engineer one day and demanded, "Well, how is the heater working?" "First rate," was the reply, "it keeps the tank from sweating." "But how about coal-saving?" he demanded. "Well, we cannot see that there is any difference," was the reply, and that was the honest opinion of both engineer and fireman. Several changes were afterwards made upon it, but they never seemed to result in reducing the quantity of coal required for the round trip.

There must have been a slight saving, but it was not perceptible. When the tank was newly filled up, it would be nearly at the water-station temperature, and then it would slowly rise until perhaps 20 or 30 degrees were added, and as the quantity reduced, the temperature would sometimes become quite high; but the average increase of heat would seldom exceed 25 degrees for the whole of the water delivered. That was not sufficient to be seen in the fuel consumption. The same practice, in a modified degree, holds good with the tender water that has to be low enough in temperature to be lifted by the injector. At the water station it has about the same temperature as the water taken in, and the most heat that can be put into it when the tank is nearly empty, is about 40 heat units per pound of water. The maximum temperature will come when the tender is nearly empty, so that the average is too low to count for much in fuel-saving.

Product of the Amateur Locomotive Designer.

The parties exploiting the Holman locomotive speeding truck are advertising the stock of their company in numerous newspapers and claiming that the invention is certain to come rapidly into general use. The effect of this has been that we have received numerous letters asking our opinion of the thing. We propose answering the letters, and those of other inquirers, in this article.

When we first heard of the Holman locomotive speeding truck, we supposed that it was the invention of some harmless crank who did not understand the elementary principles of mechanics, but we now believe that it has been, since its inception, an ostentatious machine designed to allure unwary capitalists into an investment that will be of as much real value as the throwing of cold coin over Niagara Falls. The people who are misguided enough to invest money in this scheme had better make up their minds that burning their greenbacks would bring back just as good returns.

The Holman truck consists of two sets of wheels, three below and two above the lower ones, with the drivers of the engine resting upon and engaging with the upper pairs. The wheels of the truck are of such size that the engine advances twice the distance that a single revolution of the drivers on the rail would carry it. On this account the promoters claim that they double the speed of the locomotive, and that the speed of all trains can be doubled by its use. If this assumption were correct, a locomotive with drivers ten feet in diameter would pull a train up a hill as easily as one with drivers half that size.

The Holman speeding truck is founded upon a fallacy, and does not have the meagre merit of novelty to recommend it. It is the equivalent of a geared locomotive, and that was one of the first arrangements tried in this country for the transmission of the power from the cylinders to the driving wheels. Three of the engines shown in our Historical Chart No. 2, published in the February number, were geared, and all the early Baltimore & Ohio locomotives were built in that way. The arrangement was abandoned because it was expensive to keep in repair and increased the internal friction of the engine. All others who tried that plan abandoned it for the same reason.

We do not believe that the Holman Locomotive Speeding Truck Company are anxious to push their device upon the attention of railroad men. It is capitalists they are after, and railroad men have seen too many monstrosities, called locomotives, which made a brief noise and then disappeared, to be taken in with this newest candidate for failure. All well-informed men are familiar with the history of the Fontaine locomotive, an affair with two sets of driving wheels set one above the other—a frictional geared engine just like the Holman, but with one tier less of wheels. That engine had a brief career on the Canada Southern in 1881, but it never did any useful work. The next amateur production was the Shaw four-cylinder locomotive, which was urged upon railroad men as probably no other patented locomotive was. It got many fair trials to show what it would do, but its performance never commended it for adoption. While the Shaw was under trial the Coventry return tubular boiler locomotive made a bid for popular favor, and was thoroughly tried, with the result that it soon was converted into the common form.

Something like what might be called a rival in high claims to the Holman appeared in New Jersey seven or eight years ago, and was called the Raub central power locomotive. The people who exploited this engine claimed it would run 100 miles an hour, although, on actual trial, a tenth of that speed was its limit. They made a great stir to obtain subscriptions to the stock, and pretended that immense works were going to be erected at various places for the building of the locomotives; but the whole thing ended in smoke, as the Holman is certain to do.

The only rational claim made for the Holman speeding truck is, that it distributes the weight lightly over a long wheel base. In order to obtain this small advantage, the inventor proposes to add ten extra axles, twenty additional wheels and all the necessary appliances to hold them in place. Every designer of machinery who knows his business labors to reduce the moving parts to the smallest possible number. If there is any kind of a machine where restriction of parts and simplicity of mechanism are especially essential to success, it is in railroad rolling stock. Yet this amateur locomotive designer proposes to more than double the parts of the running gear which are most troublesome to keep in repair.

If this engine, with its high center of gravity, could be run safely, and should it be found practical to keep the numerous members of the running gear in order without ruinous expense, there remains still an insuperable obstacle to developing the locomotive on the elevated plane attempted in this design. The most powerful forms of locomotives now in service that run with their wheels on the rails, have reached the limit of their capacity because the boilers are already as high as the hight of bridges and tunnels will admit. The boiler is the limit of the capacity of a locomotive, and anything which restricts the size of that reduces the work which the engine might do with a lower boiler. Where would the Pennsylvania and New York Central express locomotives reach to, if the present engines were mounted on the Holman truck?

It is hardly worth while to argue seriously about the shortcomings of the Holman locomotive, but our readers demand our views about the engine, and that is our excuse for returning to the subject.

Depriving Locomotives of Tools.

It does not cost railroad companies much nowadays to keep locomotives equipped with tools, for there is a growing tendency to cut down the small tools to a hammer and chisel and a monkey wrench. The wisdom of this cheese-paring policy is doubtful. Delays caused by want of tools, when parts of a locomotive have to be taken down on the road, soon wipe out the saving that results from the decreased expenditure for tools. While on a railroad journey, a short time ago, our train was stopped between stations by a freight train in front. The flagman said that something was wrong with the freight locomotive. With other passengers we walked forward, and found that the engine had a broken valve stem. The engineer was hacking with a chisel at a nut of the rocker pin in order to get down the valve rod. The main rod had been taken down and the big nut on the cross-head pin had been ruined by the gouging of a cold chisel. The engineer did his best, seeing that he had no wrench that would span these big nuts. The extra time our train was delayed was not less than half an hour.

Among the silly economies in vogue at the present time is that of taking the screw jacks away from engines. Screw jacks have not to be used much on the road, with the modern locomotives that break down so seldom, but when they are needed they are needed badly and ought to be provided. A superintendent who had ordered the jacks to be taken off all freight engines gave as his reason for so doing the allegation that the jacks were not powerful enough to lift heavy locomotives. That is certainly a fact of the old style of jack that was designed to help in lifting a thirty-ton engine, but it is no reason why modern locomotives should not be provided with screw jacks or hydraulic jacks powerful enough to lift the engines in an emergency. In an accident that happened last month a man died under an engine truck while the train men were jacking up the engine to get the poor fellow released. Cases of that kind are, fortunately, rare, but accidents often happen where it is highly important that the use of a powerful screw jack should be within reach.

The policy that leads to sending out locomotives without proper tools is nearly always of the narrow, short-sighted species that results in loss of time, loss of revenue and general annoyance.

Questions Suitable for Us to Answer.

The questions sent into this office to be answered in the "What You Want to Know" Department are becoming so numerous, that we are not able to spare space in which to answer nearly all of them. We wish our readers to understand that when questions are sent in to be answered, we cannot be expected to devote the investigation necessary to answer the questions properly unless they will be of interest to our general readers.

It very often happens that a man meets with a difficulty in mechanics, or in the operation of machinery, which applies to himself alone. When questions of that kind come in, we do our best to answer them directly, but it is imposing upon our time in a manner that is scarcely to be expected.

There is another class of questions that we must decline in future to answer, either through our columns or by private correspondence. They are questions relating to some specific subject, and are of no interest except to the man who asks them. To illustrate: We have on our desk a question relating to the strength of a special form of truss, to be used as a brake beam. The party who sends it has invented a peculiar form of brake beam, and thinks of getting it patented or put upon the market, and before doing so, asks us to calculate its resistance. It is not fair to expect that we should do so. There are mechanical engineers in the country, who depend on business of this kind for a living, and men having such investigations to make should apply to the mechanical engineers. That is only one of many others that are coming to us continually, and we do not think that it does justice to ourselves, to our readers or to the profession of mechanical engineering, that we should do the work gratuitously.

It is very difficult to draw the line on questions that are of an educational character, and we frequently answer questions that can be found answered in all engineering text-books, or even in school arithmetic books. It is good practice for people who are of an inquiring disposition to try and find the means of solving for themselves the answers to their questions.

Exhaust from Air Pumps Wasting Coal.

Consistency is a jewel which is not very much cherished by certain railroad men. For years past there has been constant agitation in favor of saving a margin off the fuel bills by reducing wasteful practices in the use of coal. An educational crusade has been directed upon the enginemen and the greater part of them have learned how to do their work with the least possible waste of fuel, but we are afraid that the fire of scientific instruction has been too low and has missed heads that are still responsible for highly wasteful practices.

It must be discouraging to an engineer or fireman who is striving to make a good fuel record to listen as he stands at a station to the safety valves screaming pounds of waste every minute, and to know that the exhaust steam from the air pump puffing through the smokestack is stimulating the fire to greater exertions in steam making. There are roads where sights of this kinds are to be witnessed every day and at the same time all the officials of the mechanical department are urging upon the enginemen the necessity for greater care in the use of fuel. It appears to us that many of the men at the head of railroad motive power departments have not yet learned that the exhaust steam from the air pump can be disposed of quietly, in such a way that it exerts no fanning of the fire. In Europe, the practice is general of providing a separate exhaust pipe for the air pump and securing it outside of the smokestack. That plan has several objectionable features. A much better arrangement is in use on many of our railroads and consists of leading the exhaust from the air pump into the main exhaust pipe. Others use a separate nozzle for the air pump exhaust, but enlarge it and the pipe sufficiently to permit the steam to escape at a tension too low to act as a blower, and a few roads turn the exhaust steam into the water tank.

No ordinary American mechanic would encounter much difficulty in devising means to dispose of this exhaust steam harmlessly if he were only encouraged to do so. It is high time that this encouragement was given. Our impression is that leading the steam from the air pump into the main exhaust pipe is the best plan for it helps to heat the cylinders before the engine starts.

BOOK NOTICES.

"The Materials of Construction." A Treatise for Engineers on the Strength of Engineering Materials. By Professor J. B. Johnson, C. E. John Wiley & Sons, New York. Price $6.

This is a book of 787 pages, 6 x 9 inches, profusely illustrated with a great variety of line and half-tone engravings. A great deal has been written and said of late years concerning materials of construction, but there has hitherto been no comprehensive work which could be used as a book of reference, with a likelihood of finding all the information required. Professor Johnson appears now to have succeeded in collecting in one work all the reliable data concerning engineering material that have been collected by the engineering world. He has grouped, analyzed and summarized nearly all the work done, both at home and abroad, in the direction of established fixed laws and principles in the realm of the strength of materials. Professor Johnson has for the last twelve years conducted the index of current engineering literature for the "Journal of the Association of Engineering Societies," and in connection with that work he received nearly all the regular engineering publications of the world, besides several reports giving the results of special investigations. He appears to have made remarkably good use of this mass of information, and to have digested it thoroughly, the results appearing in the book. In all cases where possible, the results have been shown graphically by diagrams, instead of in the usual tabular form. It appears to us that no engineer, having to design machinery or structures, can afford to be without this book. It covers everything hitherto published concerning the strength of material, and gives a great deal of information that formerly could be found only in scattered articles.

"The Locomotive—Its Failures and Remedies." By Thomas Pearce. D. Van Nostrand Company. Price $1.

This is a small book, 96 pages, 4½ x 7 inches, with an appendix containing a variety of plates and diagrams. The author is an engine driver on the Great Western Railway of England, and his object in publishing the book was to furnish data which would enable engine drivers to pass the examination which is becoming almost universal in Great Britain. The information is given in the form of questions and answers, and all the subjects dealt with are explained in a very intelligent manner, and in language that any man, able to read English, can understand. The plates and diagrams in the appendix are employed for instructing enginemen of the relative positions of cranks, pistons and valves, and are intended to instruct enginemen to find out what position to put their engine, to make tests of valves and pistons.

"Something about the 'American Machinist'" is the title of a small booklet published by the American Machinist Publishing Company, 256 Broadway, New York, for the purpose of spreading information concerning the character of that well-known publication. It contains a history of the paper, which in itself is quite interesting, and has a great deal of information about how technical papers ought to be run. The information is likely to be particularly useful to advertisers. Persons interested in the subject can obtain a copy of the booklet by applying to the publishers.

"The Black Diamond Express" is the title of a new quarterly publication issued by the passenger department of the Lehigh Valley Railroad at Philadelphia, for the purpose of letting the public know about the attractions of the Lehigh Valley Railroad, and the interesting and attractive places to be seen along the route. It is got out in first-class style, and illustrated with very good half-tone engravings. The outside cover is particularly striking, showing the "Black Diamond Express" on its way, the scenery, train and passengers being shown in a variety of colors.

We have received the annual catalog of the Purdue University, Lafayette, Ind., for 1897-1898. It gives a brief history of the university and describes the material equipment of the institution, and gives particulars concerning the various courses of study. The conditions of admission to the university are given, and some particulars about the examinations to be passed. To this is added information concerning the expense of living in Lafayette. Any person interested in a technical establishment which makes railroad instruction a specialty, should send for a copy of this catalog.

Doing Repairs by Piece Work.

The practice of doing locomotive and car repairs on the piece-work system is steadily spreading among railroads. There is great diversity of opinion concerning this method of doing repair work, both among those who do the work and those who have the supervision of it. In some places the work goes on very satisfactorily, and there is perfect harmony all round; in other places there are constant bickerings and heart-burnings, that keep both workmen and those in charge in a most uncomfortable frame of mind.

The difficulty of settling what should be paid for a certain job is much greater in old work than it is in new work, and it is on this account that most of the discord arises. The principal element of success in carrying on a piece-work system of repairs is fair dealing. Where fair dealing is the guiding principle with the foreman in charge, there is no difficulty in making the system a success. When a foreman displays a disposition to take advantage of the men, which he can readily do, they strive to return the compliment, and so the war goes on. It frequently happens that a job takes double the time on one engine or car that it would require in ordinary cases, and a foreman of judgment and just tendencies allows for that. The over-zealous foreman will hold the workman to his pound of flesh, and the workman will retaliate by putting bad work on jobs that he can cover up.

The functions of a foreman are entirely changed when a shop or yard first begins to do the work on the piece system. While day work is going on, the foreman's principal business is to see that the men have sufficient work to do, and that they keep steadily at it. Under the contract system, the foreman does not have to trouble himself much about the supply of work, so much as the seeing that it is performed properly. The supervision in the new style of doing work is almost entirely in the shape of inspection. Of course, the company having work done in this way has the right to demand that it will be finished in a workmanlike shape; but there is a tendency among some inspectors to demand better work from those engaged on piece work than they would if the work was done under the day system. This, of course, is unfair, and leads to disputes and hard feelings.

The heads of mechanical departments of railroads who desire to make a success of piece work ought to see that great care and judgment are exercised in the selection of inspectors. Running piece work requires much more skillful management than running day work, and where the system is a failure or unsatisfactory it may safely be concluded that a system of fair dealing does not prevail.

Large and Small Nozzles.

There has been so much said of late years in favor of keeping the exhaust nozzles of locomotives as large as possible, that the letter in our correspondence department, asserting that lubricating oil can be saved by the use of small nozzles, will sound like a piece of heresy.

We believe that the agitation in favor of large nozzles has done a great deal of good, for the simple reason that there was a great tendency a few years ago to choke down the exhaust of locomotives, so that the engine suffered chronically from back pressure in the cylinders. It does not, however, follow that a large nozzle is always conducive to steam economy. If a nozzle is so large that there is difficulty in maintaining the pressure of steam, the engine will not operate so economically as it would do with a smaller nozzle. The only advantage of a large nozzle is that it prevents the action of the exhaust from cutting the fire more than what is necessary. Within certain limits, a small nozzle will save steam by retaining in the cylinders enough back pressure to fill the clearance spaces before the beginning of the stroke.

Experiments have repeatedly been made in this direction, and it was found that less steam, per horse power, was required when a medium sized nozzle was used than with one that was very large. It is quite safe, however, as a general principle, to advocate the use of large nozzles, because inferior coal and bad weather are constantly bringing about conditions that induce the engineman to call for small nozzles.

Good Boiler Staying.

A flat surface on the sides of the wagon-top sheet of a boiler is looked upon by the boiler-maker as an inexcusable construction, if there is any possible means of making the sheet cylindrical. There has been one instance brought to our attention, however, which would seem to indicate that exceptions occasionally occur, and this one appears to come under the latter head, when passed upon in the light of its exceptional endurance.

The case in point is an eight-wheel engine on the New York, Ontario & Western Railway. This engine has a roof sheet with a pronounced flat on the sides, which, after nine years' service, has had only three staybolts replaced. The stresses tending to cause the sheet to assume a circular form were provided for by a closer pitch of bolts, and besides this, the bolts were staggered in the spacing similar to the double-riveted longitudinal seams. That this arrangement of staying was responsible for the life of the bolts, the above showing attests, but the form of sheet under consideration has been such a source of expense in the past that it is doubtful that any experiments will be made on those lines in the future.

In our last issue we published a short review of Meyer's "Easy Lessons in Mechanical Drawing and Machine Design," and mentioned that it was published by the Arnold Publishing House. It appears that there are two publishers of that name in New York, and several inquiries have been made of a publisher, who sent back word that he did not know anything about that book. We now wish to give the further information, that the book is published by the Arnold Publishing House, 16 Thomas street, New York.

Our occasional correspondent, Mr. C. H. Caruthers, of Pittsburg, Pa., contends that we were mistaken last month in saying that the Pennsylvania Railroad Company ordered twenty ten-wheelers of the "Chesapeake" type, shown in our indication chart No. 4.

PERSONAL.

Mr. E. J. Sigler has resigned as superintendent of the West Virginia Central & Pittsburgh Railway.

Colonel John Magee has been elected president of the Fall Brook Railway, to succeed his father, the late General Magee.

Mr. Geo. H. J. Edmonston, Jr., has been appointed superintendent of the West Virginia Central & Pittsburgh Railway.

Mr. H. E. Hutchins has been appointed assistant superintendent of the Atlanta & Danville Railway, with office at Norfolk, Va.

Mr. A. D. Holliday has been appointed assistant superintendent of the Duluth & Iron Range Railroad, with office at Two Harbors.

Mr. H. Ridgeway has been appointed master mechanic of the Chihauhua division of the Mexican Central Railway, at Chihauhau.

Mr. John E. Rose has resigned as superintendent of the Arkansas division of the St. Louis, Iron Mountain & Southern Railway.

Mr. I. W. Troxell has been appointed general manager of the new Queen Anne's Railroad, with headquarters at Queenstown, Md.

Mr. Jas. Tobin has been appointed traveling engineer of the Mexican National System, with headquarters at San Luis Potosi, Mex.

Mr. W. D. Robb has been appointed master mechanic of the Middle division of the Grand Trunk Railway, with headquarters at Toronto, Ont.

Mr. J. F. Deems has been appointed master mechanic of the St. Louis division of the Chicago, Burlington & Quincy Railroad, at Beardstown, Ill.

Mr. J. W. Harkom has been appointed master mechanic of the Eastern division of the Grand Trunk Railway, with headquarters at Montreal, Canada.

Mr. W. Ball has been promoted to the position of master mechanic of the Northern division of the Grand Trunk Railway, with headquarters at Allandale, Ont.

Mr. W. E. Hodges has been appointed general purchasing agent of the Atchison, Topeka & Santa Fé, to succeed Mr. W. G. Nevins, with headquarters at Chicago, Ill.

Mr. R. O. Cumback, formerly of the Illinois Central, has accepted a position with the St. Joseph Terminal Company, as foreman of their shops at St. Joseph, Mo.

Mr. J. S. Goodrich has been appointed superintendent of the Western division of the Wabash Railroad, with office at Moberly, Mo., *vice* W. A. Garrett, transferred.

Mr. Joseph H. Sands, general manager of the Norfolk & Western Railway, has resigned. Mr. J. M. Barr, vice-president, will hereafter perform the duties of that position.

Mr. J. E. Button has been appointed master mechanic of the East Iowa-Ottumwa division of the Chicago, Burlington & Quincy Railroad, with headquarters at Ottumwa, Ia.

Mr. W. E. Clark, of No. 8 Oliver street, Boston, has been appointed the New England representative of the Standard Steel Works, for the sale of tires and steel-tired wheels.

Mr. W. A. Garrett has been appointed superintendent of the Illinois lines of the Wabash Railroad, with office at Decatur, Ill. He was previously superintendent of the Western division.

Mr. Philip Wallis has been appointed master mechanic of the Eastern & Amboy Railroad, and of the Lehigh division of the Lehigh Valley Railroad, with headquarters at Easton, Pa.

Mr. Howard D. Taylor has been appointed master mechanic of the Wyoming division of the Lehigh Valley Railroad, taking the place of Mr. Roth. Headquarters at Wilkesbarre, Pa.

Mr. T. C. Sherwood has been appointed general manager of the Kansas City & Northern Connecting Railway. He was formerly assistant general manager of the Pittsburgh & Gulf Railway.

Mr. Charles O. Haines, previously superintendent and chief engineer of the Atlantic & Danville Railway, has been elected general manager, to take the place of Charles D. Owens, deceased.

Mr. Oscar O. Winter, previously assistant general superintendent of the Eastern division of the Great Northern Railway, has been transferred to the same position on the Western division.

Mr. Orrin Doolittle, formerly chemist and storekeeper of the Philadelphia & Reading R. R., at Reading, Penn., has been appointed division superintendent of the Philadelphia & Reading R. R.

Mr. W. A. Williams, general manager of the Texarkana & Fort Smith, has been given charge of the Southern division of the Kansas City, Shreveport & Gulf, also, with headquarters at Texarkana, Tex.

Mr. John I. Kinsey, for many years master mechanic of the Lehigh division of the Lehigh Valley Railroad and Eastern & Amboy Railroad, has been appointed superintendent of machinery.

Mr. James M. Gruber has been appointed assistant general superintendent of the Eastern district of the Great Northern Railway. He was formerly general superintendent of the Montana Central.

It is reported that Mr. John Hickey has been appointed geheral master mechanic of the Rio Grande Western Railway, with headquarters at Salt Lake City. The rumor, however, is not confirmed.

Our well-known contributor, Mr. W. de Sanno, has resigned the position of master mechanic of the Chicago & Southeastern. He is open for another engagement, and his address is 93 Walcot Street, Indianapolis, Ind.

Mr. Fred Roth has been appointed to take the position of master mechanic, formerly held by Mr. Wallis, of the Mahoney and Hazleton divisions of the Lehigh Valley Railroad, with headquarters at Delano, Pa.

Mr. J. B. Baker has been promoted to the position of assistant superintendent of the Pittsburgh division of the Pennsylvania Railroad, to succeed Mr. R. I. O'Donnell. He was formerly assistant engineer of that division.

Mr. J. F. Sheahan has resigned as master mechanic of the Fourth and Sixth divisions of the Plant system, with headquarters at Palatka, Fla. Mr. Sheahan is now open for an engagement. His address is San Antonio, Fla.

Mr. F. S. Hammond has been appointed assistant general manager of the Kansas City, Pittsburgh & Gulf Railroad, with office at Kansas City. He was formerly general superintendent of the Kansas City, Shreveport & Gulf.

Mr. C. W. Eckerson, who was appointed master mechanic of the East Iowa division of the Chicago, Burlington & Quincy Railroad at Burlington, *vice* Joel West, deceased, died suddenly, of apoplexy, within a month after his appointment.

Mr. Geo. M. Tower, foreman and engine dispatcher of the locomotive department of the Fitchburg Railroad at Fitchburg, has been appointed acting master mechanic of the entire system of the Fitchburg Railroad. His jurisdiction will extend over all locomotives and shops, with headquarters at Charlestown, Mass.

John P. Cuddy, a farmer, of Baltimore County, Md., died on March 10th, in his 88th year. Mr. Cuddy made the first trip on Peter Cooper's locomotive over the B. & O. on August 28, 1830. He was also present when Professor Morse sent the first telegraphic message over the B. & O. wires between Baltimore and Washington.

Adrien Poncet, who was the first to run a locomotive in France, recently died at Tours in his 82d year. In 1836 he ran the engine of the first passenger train from Paris to St. Germain. He remained in the service of the company till a few years ago, when he retired with a pension, and was decorated with the Cross of the Legion of Honor.

Mr. E. B. Thompson has been appointed mechanical engineer of the Northern Pacific, with headquarters at St. Paul, Minn. Mr. Thompson has been for twelve or fifteen years chief draftsman of the Chicago & Northwestern at Chicago, and has practically performed the duties of mechanical engineer. He is a member of the American Society of Mechanical Engineers.

We understand that Mr. Wm. H. Wiley, of the well-known firm of John Wiley & Sons, publishers, New York, and the New York correspondent of London "Engineering," has applied for the commissionership of the Paris Exposition in 1900. Mr. Wiley is eminently fitted to grace a position of this kind, and we do not think that the government would find a man better adapted to represent American interests.

Mr. John McCurdy, the oldest surviving engineer in active service on the Michigan Central, began firing April 1, 1848, and has been on the road steadily from that date up to the present time without a serious mishap. He has never been suspended from duty, and was never censured for any infractions of the rules of the company. He has been on the same run now for over thirty years. This is a continuous record seldom surpassed by any locomotive engineer.

Nelson Collinge, machinist and an old-time locomotive engineer, aged 63 years, died at Pensacola, Fla., April 3d. In his younger days he ran on the Memphis & Charleston Railroad, and on the Clarksville division of the L. & N. R. R., having been almost continuously in the employ of the latter company since 1860 up to within three days of his death. Mr. Collinge was a man of more than average intelligence, a subscriber and warm friend of "Locomotive Engineering." He leaves a widow, but no children.

On April 16th, the Westinghouse Air Brake Company passed the half-million mark in the manufacture and shipment of freight-car brakes. They have now sold 503,519 sets of their automatic air brake for freight cars.

The West Shore Railroad Company proposed closing up their repair shops at Frankfort, N. Y., and having the work done in the large New York Central shops at Depew, near Buffalo, but a difficulty has arisen which will delay the move. When the shops were established at Frankfort, the people of the town raised money to help defray the expense of building them, and now a committee of the citizens have given notice that they will sue the company for breach of contract if the shops are removed.

EQUIPMENT NOTES.

The Pullman Company has two sleeping cars under way for the Missouri Pacific Railway.

Fifteen engines are being built for the Erie Railroad, at the Baldwin Locomotive Works.

The San Francisco & San Joaquin Valley Railway is having 50 freight cars built at Pullman's.

The Baldwin Locomotive Works are building one engine for the Low Moor Iron Company.

The Mather Stock Car Company is having 50 cars built by the Ohio Falls Car Company.

The Schenectady Locomotive Works are engaged on two engines for the Rutland Railroad.

The Richmond Locomotive Works are building ten engines for the Chesapeake & Ohio Railway.

Forty-six freight cars are under way at Pullman's for the San Antonio & Aransas Pass Railway.

One engine for the Manistique Railroad is being constructed at the Baldwin Locomotive Works.

One engine is being built for the Louisville & Nashville Railroad, by the Baldwin Locomotive Works.

The Arizona & Southeastern Railroad is having one locomotive built at the Baldwin Locomotive Works.

Three engines are under way at the Rogers Locomotive Works, for the Keokuk & Western Railroad.

The Mexican Central Railroad is having 600 freight cars built by the Michigan-Peninsular Car Company.

One engine is being built at the Richmond Locomotive Works for the Atlantic & North Carolina Railroad.

The Mt. Vernon Car Company is building 100 coal cars for the Louisville, Evansville & St. Louis Railroad.

One locomotive is being built for the Esquimault & Nanaimo Railway, at the Baldwin Locomotive Works.

Five 20 x 26, 10-wheel engines are being built at the Cooke Locomotive Works, for the Southern Pacific Railway.

The Baltimore & Ohio is having 1,000 cars built at Pullman's and also a number built at the Baltimore Car Works.

The Florence & Cripple Creek Railroad has given an order for nine passenger cars to the St. Charles Car Company.

One hundred cars for the Cold Blast Transfer Company are being constructed by the Wells & French Car Company.

Fifty cars are under construction by the Carlisle Manufacturing Company for the Pennsylvania Coal & Iron Company.

The Haskell & Barker Car Company has received an order for 350 coal cars from the Chicago & Eastern Illinois Railroad.

At the Topeka shops of the Atchison, Topeka & Santa Fe, there are twelve 20 x 28-inch consolidation engines being built.

There are four locomotives under construction for the Detroit, Lima & Northern Railway, at the Baldwin Locomotive Works.

The Rio Grande Western Railway has ordered 100 stock cars and 100 coal cars, it is reported, from the Ohio Falls Car Company.

The Chesapeake & Ohio Railway is having two vestibuled combination baggage and smoking cars built by the Pullman Company.

An order for two passenger and two switching engines has been placed with the Brooks Locomotive Works, by the Louisville, New Albany & Chicago Railway.

Ten Mogul engines are being constructed by the Pennsylvania Railroad Company at the Juniata shops, with a prospect of building ten passenger engines in the near future.

The Southern Pacific Railway is having ten engines built, five of them at the Schenectady Locomotive Works and five at the Cooke Locomotive Works—all of them for passenger service.

The Schenectady Locomotive Works have an order from the Southern Pacific Railway for five more ten-wheel passenger engines, similar to those built by them for the same company at the beginning of this year.

An order has been placed by the Pittsburg, Bessemer & Lake Erie Railroad, for nine engines, apportioned as follows: Brooks Locomotive Works, three; Baldwin Locomotive Works, three; and Pittsburg Locomotive Works, three.

Twelve engines are said to have been ordered by the Kansas City, Pittsburg & Gulf Railroad, the order being divided between the Pittsburg Locomotive Works, the Brooks Locomotive Works, and the Baldwin Locomotive Works.

The Baltimore & Ohio Railroad has ordered 260 coal cars from the South Baltimore Car Company, for use by the Consolidation Coal Company, Black, Sheridan & Wilson, and George's Creek Coal & Iron Company, on the Baltimore & Ohio system.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(33) E. R., Galveston, Tex., asks:

Will you inform me through your columns as to whether an engine can handle a heavy train easier going ahead than when backing up, and if so, what is the reason? A.—Our experience with locomotives has never shown any difference in the power developed by an engine going ahead or backing. Theory bears out this statement, and if any different results have been reached by tests, we are not in possession of the data.

(34) R. H. S., Brooklyn, N. Y., asks:

1. Why or how does the oil in a lubricator get into the condenser and ooze out around the steam and syphon connections where they screw into the condenser? A.—There are certain conditions under which the lubricator will syphon, heretofore explained in this paper, and when doing this, the condenser will be filled with oil. The leakage around the connections can then be accounted for, as oil will find its way through a joint that is practically steam-tight. 2. Why do some sandboxes sweat on the inside, especially those on saddle-tank engines? A.—The sweating is due to the moisture in the sand, and the confinement of the former in the sandbox through lack of ventilation causes condensation.

(35) M. D. J., New Whatcom, Wash., asks:

What advantage is there in making the main rod (when it is fluted) the same size for the whole length as some builders do? A.—There is no gain in such construction, and it is open to serious criticism on the ground of excessive reciprocating weight. 2. What advantages have iron over copper flues, or vice versa? I notice that the former are used almost exclusively in this country, and the latter in England. A.—Experiments to demonstrate the relative evaporative efficiency of iron and copper flues, have shown that when both metals were clean, that the copper had a thermal conductivity of 1.000, while the value of the iron was represented by 0.5814, or a little more than one-half that of the copper; but the conditions of the experiments never obtain in practice, for the surfaces are covered with scale and soot, outside and inside, respectively. Under the latter conditions, exhaustive tests have shown that there is no difference in the evaporative results between iron, steel, copper or brass.

(36) C. C. L., Buffalo, N. Y., writes:

Please explain what is meant by an "intercepting valve," and what are its functions as used on the Vauclain compound locomotive. A.—The small valve controlling the passage of steam to the cylinders of compound engines, received its name of "intercepting valve" from the fact that it cut out connection between the receiver and the low-pressure cylinder while the engine was working live steam in both the high and low-pressure cylinders at starting. After starting, the high-pressure cylinder exhausts into the receiver, and the resulting pressure moves the intercepting valve so as to cut off live steam from the low-pressure cylinder, and at the same time open communication between the latter and the receiver, and allow the engine to work as a compound. This valve on the Vauclain compound is simply a plug cock which admits live steam to the high and low-pressure cylinders, and is called a "starting valve," for the reason that when starting a heavy train, it is opened to admit steam from one end of the high-pressure cylinder to its opposite end, and from there through the exhaust passage to the low-pressure cylinder, and thus work as a simple engine. This valve is also a cylinder cock for the high-pressure cylinder, and performs its function as such, simultaneously with those on the low-pressure cylinders, being opened and closed by the same lever.

(37) H. J. R., Cedar Rapids, Iowa, writes:

On page 319 of the April issue, in answer to A. J. C., Janesville, Wis., the bending moment of a 48 x 5 x ¾-inch crown bar for a load of 30,240 pounds, is given at 151,200 inch-pounds, and the fiber stress at 23,924 pounds per square inch. I have carefully worked out this problem according to formulas in general use, with a different result, namely, a bending moment of 181,440 inch-pounds and a fiber stress of 12,904 pounds. A.—The bending moment found in our calculation is correct for the load given, on a crown bar 40 inches long, which is more nearly correct, to the bearings, or points of reaction, than would be the total length of 48 inches, for the reason that most crown bars have a bearing on the flue sheet as well as on the edge of the side sheet. This fact was not stated in the answer referred to, neither were the processes given from which the results were deduced. For the benefit of our correspondent and others who may take an interest in the subject, we give the work as followed in the case under inquiry, the load supported by the crown bar being, as before, 30,240 pounds. Let W = distributed load, M = bending moment, I = moment of inertia, C = distance from the neutral axis to the outermost fibers, L = distance between supports, and S = greatest horizontal unit-stress. Then $M = W L \div 8 = (30.240 \times 40) \div 8 = 151{,}200$ inch-pounds, as before; $I = (b h^3 2) \div 12 = (0.75 \times 5^3 \times 2) \div 12 = 15.62$, for two ¾ x 5-inch bars. C in this case equals 0.5 hight of the crown bar, or 2.5 inches. $S = M C \div I = (151{,}200 \times 2.5) \div 15.62 = 24{,}192$ pounds per square inch. The reason our correspondent obtained a lower fiber stress while having a greater bending moment, can be traced to his erroneous moment of inertia, which was found to be over twice that used above. If the correct moment of inertia had been used for a divisor, the fiber stress would have been 29,039 pounds for the bar 48 inches long, instead of 12,904 pounds. A difference of 268 pounds will be noted between the fiber stress first given and that shown by our last calculations, an error that in nowise affects the truth of the statements made.

(38) H. T., Paducah, Ky., writes:

Please answer the following questions: 1. A 17 x 24 passenger engine has valve dimensions as below: Steam ports, 1¼ x 15 inches; exhaust, 2 11-16 x 15 inches; bridges, 1⅛ inches; travel, 5 inches; outside lap, ¾ inch; inside lap, 0. Engine has 60-inch wheel and makes high piston speed, acting, while doing so, as if she had too much compression. Please give your opinion of size of ports, and say if a little inside clearance would not be beneficial. A.—The ports are fully as large as is generally given to a 17-inch engine; in fact, a little larger. The supposition that clearance would be of any assistance is a rational one, but such action should only be taken after applying an indicator to the engine; positive evidence of what is going on in the cylinder is what is wanted. 2. How should a comparative coal test be made between two engines pulling the same train over the same division; the engines being of similar dimensions except in driving wheels, the engine with the smaller wheels having to make about 20,000 exhausts more than the other in going over the division? A.—The disparity in size of wheels does not have any bearing on the question of a fuel test. If the object of the test is to determine the evaporative value of the coal, it is necessary to accurately weigh all the fuel and measure all the water used in hauling the train from terminal to terminal. If the object is to determine the amount of coal consumed by each engine in doing the same work, the process is exactly the same. The data to obtain can be simple or elaborate, as may be decided upon. If simple, let it be only the coal and water used for the given mileage. It is recommended, however, that the following information be collated, for it will be found not too complete for future reference: Miles run; water used in gallons; tons of coal used; weight of train in tons. From these points can be tabulated: Gallons of water per ton of train; pounds of coal per ton of train, and pounds of water evaporated per pound of coal. In addition to this, the average steam pressure and the average temperature of the feed water should be accurately recorded in order to deduce the equivalent evaporation at and from 212 degrees.

Southern Railway Steel Crosshead.

The steel crosshead has furnished an opening by which to partially escape the evils of excessive reciprocating weight, and has met with favor at the hands of all who were anxious to reduce the weight without a sacrifice of strength to lightness.

In most cases, however, the change from gray iron to steel has not been attended by any startling innovations in design, the old pattern being usually considered satisfactory in outline, and simply reduced in weight to meet the conditions.

Something new in crossheads for heavy power is shown in our engraving of a working drawing, representing the practice adopted for trial by Superintendent of Motive Power W. H. Thomas, of the Southern Railway, for his 21 x 28 ten-wheeled passenger engines. It was designed by Mr. Chris. Thomas, master mechanic of the Southern at Alexandria, Va., who has given proof of his familiarity with the needs of the case by a mechanical-appearing production.

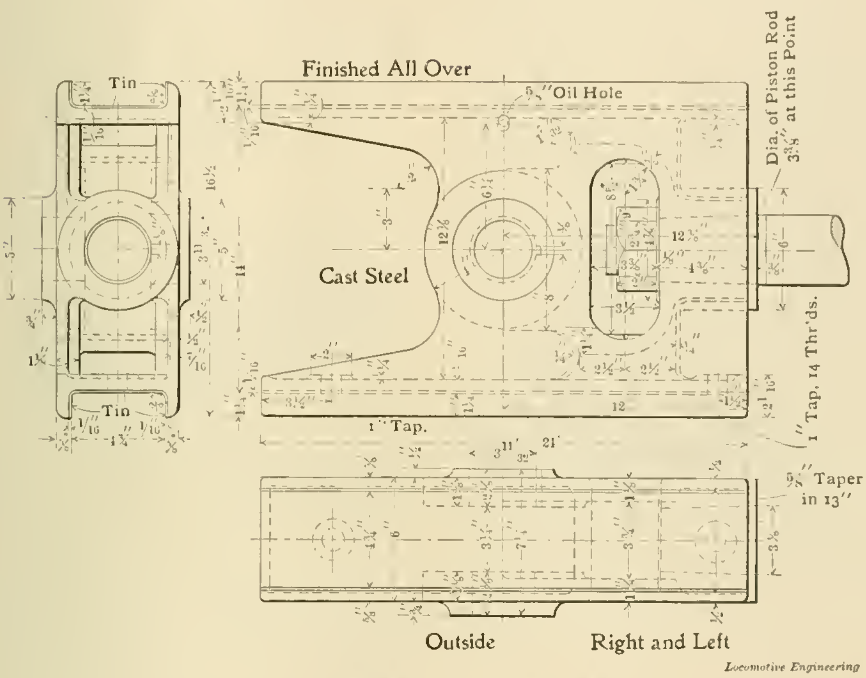
This crosshead is very light, weighing only 167 pounds, as against 287 pounds in the old one of gray iron, which it displaces. A study of the dimensions and distribution of metal explains how the required strength is obtained with the minimum of material.

No gibs or shoes are used; the guide wearing surfaces are tinned 3-16 inch thick on faces and flanges, and have a fillet of ⅜-inch radius at the junction of the two surfaces; the guides are rounded over to a like radius. These wearing surfaces, coupled with their liberal length of 24 inches, have all the elements to give a long lease of life to the parts subject to friction.

Securing the piston to the crosshead by means of the barbarous key is done away with, and the nut takes its place, with a cotter in the end of the rod, making an ideal piston fastening, than which few have been found to give a better account of themselves. Coring the crosshead to form a pocket for the nut, gives an opportunity to dispense with metal, and it is made use of. The piston rod does not shoulder on the crosshead; an abrupt taper takes the place of the shoulder, and runs out into the body of the rod. It looks as though the strong man would be powerless to do his Vandal act of splitting it, or pull off the end of the piston rod.

Each crosshead has a prick-punch mark at the center of the ⅜-inch collar, on the outside face, so as to be easily seen, and the piston has a corresponding mark, so as to insure the location of the packing joint at the bottom of the cylinder. As simple as this matter is, it is given the dignity of a drawing and clear instructions to cover it.

The record for wear and cost of maintenance is, so far, highly satisfactory; the new crossheads seen under construction in various stages of completion, bear witness to the fact that they are thought to be a good thing on the Southern.



SOUTHERN RAILWAY CROSSHEAD.

Cleaning and Sharpening Files.

Files and rasps used for working tin and lead can be cleaned and sharpened in the following manner: Dip the file for a few seconds into concentrated nitric acid until reddish brown vapors commence to ascend lively, then rinse in water, rub with a sharp brush and imbed the file in sawdust or coal dust or dry it quickly for immediate use. A file clogged up by iron filings should be dipped into a watery solution of copper vitriol by which the filings are dissolved and copper precipitated in the form of a slimy sediment while the body of the file is attacked but little. Afterwards rinse the file in water, brush off, dip into nitric acid and conclude treatment as above. Files dulled by zinc filings are given a bath in diluted sulphuric acid, otherwise they are subjected to the same treatment. Clean all files used for working copper by means of nitric acid, but repeat the process several times, because the first time much copper is precipated that adheres tenaciously to the body of the file. Files used for working wood are first put into hot concentrated sulphuric acid, rinsed, brushed, then dipped into lye of potash, rinsed and brushed again and finally dried. Drying can be accomplished best and quickest by pouring alcohol over the file and burning it off.

The Ashcroft Manufacturing Company, 111 Liberty street, New York, have issued two illustrated catalogs lately, one of them showing up their continuous recorder for steam, electric and cable engines, and the other illustrating and describing the Tabor indicator, with the new attachments which have been applied to it. These pamphlets will be sent free, if applied for, to those interested in the devices illustrated.

Malleable Castings.

In the course of a conversation recently with a superintendent of motive power, he told the writer that he had abandoned the use of malleable iron because he did not consider that it was any better than good gray iron castings. On inquiring where he obtained his malleable iron castings, the name of an establishment was given, which explained the reason why he did not find malleable iron castings a success.

It had happened that the writer witnessed drop tests of car couplers, where some of that concern's castings were broken, and it was very evident that they had no right to be called malleable iron castings; they were the commonest kind of gray iron. That is not, by any means, the only establishment that pretends to be making malleable iron castings, when their product has no right to the name. The demand for cheapness has had a good deal to do with degrading the quality of nearly all railroad supplies, and malleable castings have probably suffered deterioration more than other goods, because there have been no recognized tests for malleable iron castings.

Under these circumstances, a paper brought before the Western Railway Club recently by Mr. C. L. Sullivan, on "Specifications of Malleable Castings," is very timely. Mr. Sullivan, who is mechanical engineer for the National Malleable Castings Company, is particularly well informed on the subject, and he recommends certain good practical tests to which malleable iron shall be subjected. If railroad companies would take his advice, and subject with certainty all malleable iron castings to the rigid tests Mr. Sullivan prescribes, there would be less reason for complaint against this material. Railroad companies that fail to follow this successful course have no right to complain, when inferior material is imposed upon them.

Decorating Trains.

For the last twenty years railroad companies, as a rule, have been prohibiting the decorations of locomotives by enginemen, but the rules in this respect have not been very urgently enforced on many lines. Enginemen often like to have stag-horns ornamenting the headlight, fancy flag-holders and ribbon decorations on different parts of the engines. When this taste for ornamentation has been kept in strict moderation, no objection has been raised to it, but the great amount of engine decoration that prevailed during the recent political campaign seems to have stirred up the railroad companies to renewed activity against the fad.

The Pennsylvania Railroad Company has issued a strict order, prohibiting any decoration whatever being placed upon engines that is not authorized by the mechanical department. The "Railway World" says that recently an engineer forgot to make note of the regular signals because his attention was absorbed by the decorations, and a disastrous collision was the result. It is obvious that branches of trees, flowers and ribbons are likely to prevent signal flags being seen readily, and anything that will restrict the view of a signal has no right to be put on the engine. Moreover, people with artistic taste understand that ribbons, flowers and tree-branches have a distorting, instead of a decorative, effect on anything like a locomotive.

On the New York Central, streamers are not allowed on the coaches, and parties traveling with cars decorated in that fashion must undergo the humiliation of having them taken off just as soon as they strike that line. Some years ago a young man, leaning out of a car-window, was caught by the flow of one of the streamers on a decorated train and pulled out of his seat, sustaining injuries which entailed a loss of $10,000 on the company. That settled the streamer and decorative question on the New York Central, and other railroads would not suffer much in having rules enforced against any decorations whatever which may become a source of danger.

Mr. F. N. Pike, the genial proprietor of the Hygeia Hotel, Old Point Comfort, Va., is preparing to make it particularly comfortable for the members of the Master Car Builders' and Master Mechanics' associations, which meet at Old Point Comfort in June. Although the headquarters of the associations will not be in the Hygeia Hotel this year, it is likely to attract a good many of the older members, for they had not forgotten the solicitude displayed by Mr. Pike for their comfort during the two conventions that have used the Hygeia as headquarters. A strong attraction connected with the Hygeia is the surf bathing. It is quite a convenience in the morning to don a bathing-dress in one's room and take a swim before dressing.

Valuable Boiler Records.

There is a system of keeping in touch with the condition of steam gages, staybolts and spark arresters, on the New York, Ontario & Western Railway, that is worthy of imitation by any master mechanic that cares to be posted at all times in those important particulars. The record of the parts named is in written form, each one by itself in a book devoted to that one purpose, which is kept in the office for reference. For steam gages the respective columns are headed: Engine number, date tested; gage number; maker of gage; condition; by whom tested. For staybolt inspection the entries read: Engine number; date of inspection; number of bolts broken; number of bolts removed; number of bolts applied; size of bolts removed; size of bolts applied; name of inspector. This report is supplemented by a diagram of the firebox end of a boiler, showing the location of bolts removed or replaced, and gives more minute information than the written record.

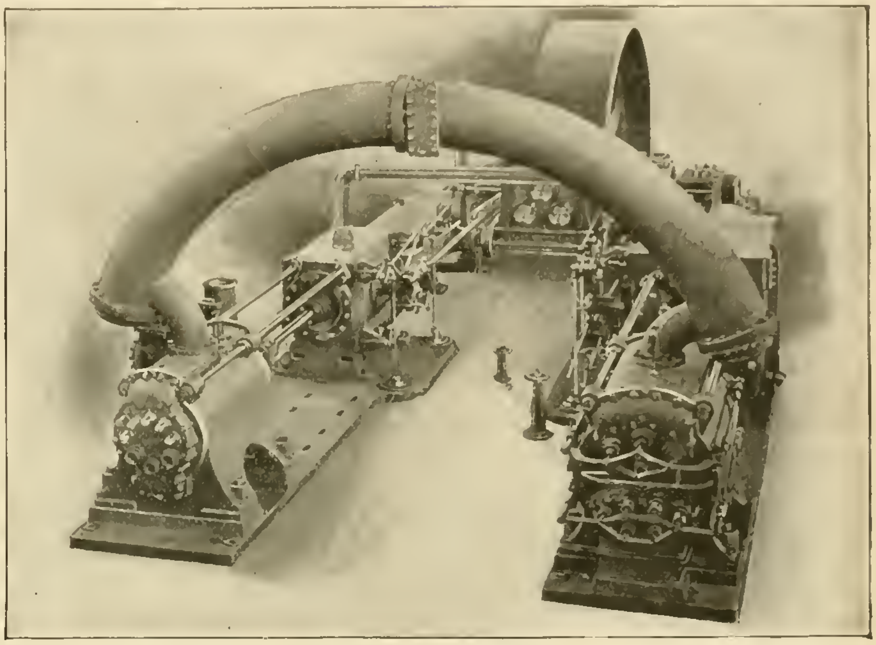
Spark-arresting appliances and ash pans are recorded in substantially the same manner; the information conveyed bearing directly on the condition of these parts, and when and by whom inspected, for each engine. These records are permanent in ink and signed by the man in charge of the department responsible for the data, and they must therefore be an improvement over any system of printed slips, which can be conveniently lost if it is necessary for an interested party to produce certain facts of a character damaging to himself.

The Largest Compressor Engine in Canada.

The compressor engine shown in engraving is the largest ever put in operation in Canada, and was recently installed at the famous Le Roi mine, Rossland, B. C.

It was built by the Rand Drill Company, of 100 Broadway, New York City, at their Canadian shop at Sherbrooke, P. Q., and is described as a beautiful piece of mechanism, as it was shown standing on shop floor at time of inspection.

On the steam end the engine is of the Corliss type, made in the form of a cross compound condensing machine. The high pressure cylinder is 22 inches in diameter by 48-inch stroke, taking steam through a pipe 6 inches in diameter. The low pressure cylinder on the opposite side of the machine is 40 inches in diameter by 48-inch stroke. Both cylinders are fitted with the Corliss liberating type valve, with vacuum dash pot, and with a sensitive governor operating on the release gear, to be operated automatically from six or eight revolutions to the maximum number of revolutions per minute. The main shaft is 14 inches in diameter by 13 feet long, weighing about 5,500 pounds. The shaft is fitted with cranks pressed on under immense pressure



THE LARGEST COMPRESSOR ENGINE IN CANADA.

We have received a letter from Mr. Clement E. Stretton, continuing the discussion about the merit of Joy's valve gear. There are so few readers of "Locomotive Engineering" interested in the question, that we must declare the discussion closed.

The Garden City Sand Company, of Chicago, have put upon the market a tile arch for the use of blacksmiths, which is a unique invention. It is employed to partly cover the blacksmith's fire, and has the effect of concentrating the heat to such a degree that it effects a considerable saving of fuel.

The Louisville, New Albany & Chicago people are using the Bane-McGrath Company's air hose coupling and angle cock, and they claim that it overcomes all shortcomings of the ordinary angle cock.

Sargent Brake Shoe.

The annexed engraving shows the Sargent-Stevens open-hearth steel driving brake shoe, which has several peculiar features, as an examination of the engraving will show. The object of this invention is to distribute the metal of the shoe in such a way as to get a maximum contact with those portions of the wheel tread and flange, which are not touched by the rail. The shoe is reported to be particularly successful in keeping the tires in good condition of switching, and other engines that usually groove the tire very rapidly.


SARGENT BRAKE SHOE.

A number of engines on several railways are now fitted with both Westinghouse and vacuum brakes, so as to be able to handle trains fitted with either system. To enable the two brakes to be operated simultaneously with one handle, when the engine has a set of gear working on the air principle, and the carriages have vacuum apparatus, an ingenious valve has been introduced in the vacuum train pipe immediately below the injector on the footplate. The admission of air to the vacuum train pipe destroys the equilibrium of the valve, which in moving allows air to escape from the Westinghouse pipes, consequently applying the brakes both on the engines and carriages at one and the same operation.—Moore's "Loco. Magazine."

The Yale & Towne Manufacturing Company, Stamford, Conn., have issued an illustrated pamphlet, showing their new triplex chain pulley block. This appears to be the largest portable chain hoist on the market and has a capacity ranging from 16 to 20 tons. The duplication of the hoisting mechanism enables the full power of four men to be utilized, either in lifting a maximum load at normal speed or lighter loads at great speed; whereas all other hoists have heretofore had but a single hang chain, on which it is not possible to utilize effectively the power of more than two, or at the most three men. Those interested in chain hoists ought to send for this pamphlet.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have just received an order from Messrs. De Fries & Co., of Dusseldorf, Germany, for $25,000 worth of machine tools. They have also received a large order amounting to $10,000 from the Volga Steel Works, of St. Petersburg, Russia. They report their export business as increasing very rapidly. Also report that business in the United States shows encouraging signs of improvement.

The locomotive belonging to the Duluth & Iron Range Railroad, which is equipped with the variable exhaust nozzle mentioned several times in these pages, appears to be keeping up its reputation for economy. We have received a statement of the performance of six engines during the months of February and March. The average miles per ton of coal run by five of the engines was 23.1 in February and 24.6 in March.

In giving evidence before the Ways and Means Committee of Congress, a manufacturer of agricultural implements said: "Some years ago I visited a large agricultural implement factory in England, at the invitation of its owner, a member of Parliament. I found finished plow handles and beams produced in that factory at a labor cost of more than $1, while similar work costs us but 10 cents at our factory in York, Pa.

The San Francisco "Examiner" says the largest tree in the world lies broken and petrified at the north end of a defile of Northwestern Nevada. This monster tree lies partly buried in the ground. It was at its butt quite 60 feet in diameter, and measured 666 feet long. No limbs remain, although the clefts where they were broken off are to be seen.

The Chicago, Burlington & Quincy passenger department have issued a little circular called "1,025 Miles in 1,047 Minutes," giving a few of the leading particulars of the extraordinarily fast run made from Chicago to Denver with a special train.

The next annual meeting of the American Society of Railroad Superintendents will be held at Nashville, Tenn., beginning on Wednesday, September 22, 1897.

The Buffalo Forge Company, Buffalo, N. Y., is now executing an order for a large dryer for a laundry in Paris, France, received through its office in that city. In the United States these dryers have been used in a multitude of places, but it is only within the last year or so that they have been shipped abroad. One of the largest outfits in this country is used in connection with the Auditorium Hotel, Chicago, since which installation they have been very materially improved. The rapidity with which fabrics may be dried by the proper applications of heat and air, afforded by the Buffalo fan system, as compared with the slow process of heat only from steam coils or other sources, is the index of the success of the Buffalo fan system laundry dryers.

Fifty years ago last month, the legislature of New York passed a bill which permitted the consolidation of ten small railroads between Albany and Buffalo into what is now the main line of the New York Central. Com. Vanderbilt was the controlling spirit in the enterprise, and he gave the Empire State a good through railroad, in place of a lot of small ones, which gave poor service and caused much delay in travel. It was sixteen years later that the same master mind brought about the consolidation of the New York Central, Hudson River & Harlem lines with the Western portion.

The Boston fire department is having a horseless fire engine built by the Manchester Locomotive Works, in New Hampshire, which will run by steam. The chief engineer rides at the side of the firebox, all the levers and wheels controlling the engine arranged conveniently for him as in a locomotive, the assistant engineer steering by means of a brake arranged in front of the front seat. This is a very powerful engine and travels twelve miles an hour and climbs as steep hills as any horse con climb, besides having great projectile power for the forcing of water to the top of sky-scrapers.

"South America—Its Resources and Facilities," is the name of an illustrated pamphlet by John A. Johnson, recently received in this office from the Gisholt Machine Company, Madison, Wis. It is a very interesting pamphlet and gives half-tone cuts of many striking scenes in South America. Those who are in any way interested in South American affairs will find that the reading of this pamphlet will greatly increase their knowledge of the subject. The pamphlet can be obtained from the above company.

The Hayden & Derby Manufacturing Company, 111 Liberty street, New York, have issued a new illustrated catalog, showing the Metropolitan automatic injector. Besides a series of first-class engravings showing the injector and its details, there is a good deal of useful information concerning the use of injectors. Those interested can have the pamphlet, on application to the company.

"Suburban Homes" is the title of a very handsomely got out pamphlet, recently published by the Lehigh Valley Railroad's passenger department of Philadelphia. The Lehigh Valley passes through some of the finest scenery in America, and the pamphlet contains some charming pictures of attractive places in the neighborhood of New York.

The Peerless Rubber Manufacturing Company, Warren street, New York, have issued a new illustrated catalog, showing part of the immense variety of goods manufactured by the company. The catalog is printed in colors, and is got out in first-class style. Anyone interested in rubber goods will find this catalog a useful addition to their file.

Railroads are not experiencing much benefit from the good times that have been so confidently predicted as being due in the first months of this year. A bad sign is the news that the Chicago & Alton, one of the best managed railroads in the West, have reduced their shop force at Bloomington by laying off 100 men.

The suit of the St. Louis Car Coupler Company against the National Malleable Castings Company was decided by Judge Taft, of Cincinnati, on Monday in favor of the National Malleable Castings Company, to the effect that the Tower coupler does not infringe. The bill was dismissed at the cost of the complainant.

The Foster Engineering Company, of Newark, N. J., state that during 1896 they consumed over 32,000 pounds of Government composition and steam metal, together with many tons of malleable and cast iron, in the construction of their pressure regulators and reducing valves.

The Boston Belting Company have recently placed the agency for their mechanical rubber goods, in Atlanta, Ga., with the Graton & Knight Manufacturing Company, the well-known leather belting manufacturers.

INDEX TO ADVERTISEMENTS

PAGE

Buyers' Finding List.

(Continued on page 388.)

BUYERS' FINDING LIST—*Continued.*

BOILER COVERINGS.
Carey Mfg. Co., Philip, Lockland, O.

BOILERS.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

BOILER TUBES, LOCOMOTIVE.
Allison Mfg. Co., Philadelphia, Pa.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.

BOOKS.
American Industrial Pub. Co., Bridgeport, Ct.
Andel & Co., New York.
Griffin & Winters, Chicago, Ill.
H. C. Baird & Co., Philadelphia, Pa.

BORING MILLS.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BUFFERS, BLOCKS, SPRING.
Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
Williams, White & Co., Moline, Ill.

CARS.
J. G. Brill Co., Philadelphia, Pa.
Lima Locomotive & Machine Co., Lima, O.

CAR COUPLERS.
Gould Coupler Co., Buffalo, N. Y.
Latrobe Steel Co., Philadelphia, Pa.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
Sams Automatic Coupler Co., Denver, Col.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

CAR DOOR FASTENERS.
National Malleable Castings Co., Chicago, Ill.

CAR FORGINGS.
Dickson Mfg. Co., Scranton, Pa.

CARS, FREIGHT.
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(*Continued on page 389.*)

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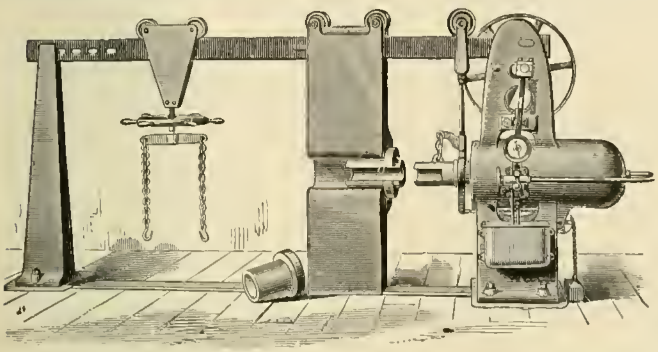

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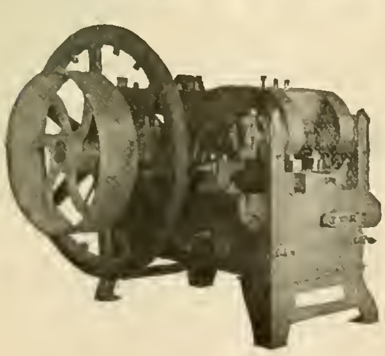

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(*Continued on page 390.*)

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(*Continued on page 391.*)

NOW FOR THE FISH STORIES!

All Indications Point to a Great Season for the Anglers.

"The ice is out!" How much these four little words will mean to thousands of eager sportsmen, when, in a few more days, they are flashed over the wires from the teeming lakes and rivers that make northern New England such a paradise for the angler.

Hundreds of newspapers scattered all over the land will spread the gladsome message before their readers; and at the clubs and other meeting places, where disciples of the rod and reel are wont to gather, "the ice is out" will be a far more absorbing topic of discussion than tariff bills or arbitration treaties.

Transportation people, and those engaged in supplying the material wants of the amateur fisherman, are all agreed that the present fishing season in New England is likely to be a "record breaker," just as was the recent hunting season in Maine. Everybody who has ever been in the habit of "going fishing" is down for a trip to his favorite haunt this spring, and hundreds more who have never tasted the delights of this glorious pastime are booked for their initial experience with rod and fly.

As far as it is within the bounds of human fallibility to foresee, the returns upon their investment of time and money are likely this year to exceed those of any previous season, too. The finny tribe, like New England weather itself, is somewhat fickle in temperament; but somehow or other it seems to be "in the air" that the fish are not only going to be big and plentiful this spring, but that they are going to rise to the fly with the unanimity and celerity of a lot of office-seekers after a fat consulship.

This, at any rate, is what the guides "down" in Maine and "up" in New Hampshire are predicting, and they ought to know.

Thanks to the untiring efforts of the State and National Fish Commissions, supplemented by the public-spirited work of scores of private citizens, the inland waters of New England are more than ever alive with trout and salmon and bass, and the multitude of other gamey fish that the angler delights to lure.

Thanks, also, to northern New England's great transportation system, the Boston & Maine Railroad, the task of reaching these favorite fishing grounds of Rangeley, Moosehead, Winnipesaukee, Asquam, Sunapee, Champlain, Memphremagog, Willoughby and Connecticut lakes, the White Mountains and Pemigewasset Valley, the Restigouche and other Canadian resorts, is no longer a task at all, but a distinct pleasure.

This year the facilities for reaching any and all of these famous fishing centers are better than ever before, and the sportsman leaving Boston on an early morning train finds himself enjoying a hot supper in the very heart of the Rangeley region; while, if his destination be the Moosehead fishing grounds, he may leave the Hub on the night express and make his first cast under the shadows of Mount Katahdin the following afternoon.

Other points, like Winnipesaukee and Sunapee, where the fishing is excellent but the surroundings more "civilized," are reached almost before one has gotten comfortably settled for the journey.

The passenger department of the Boston & Maine—which is an official and infallible bureau of information concerning everything relating to outdoor life in New England—is prepared to furnish intending sportsmen with illustrated guide-books, tickets, time-tables and "pointers" in general regarding the fishing regions along the Boston & Maine system or its connections. An application addressed to D. J. Flanders, General Passenger Agent, Boston, will meet with prompt response.

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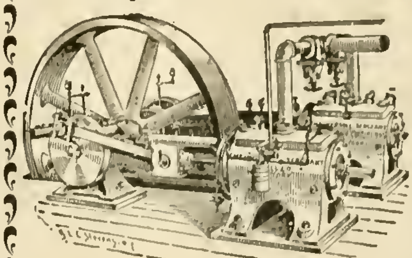

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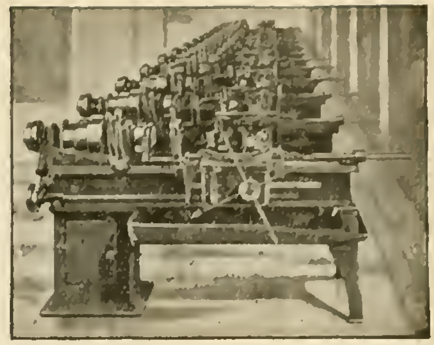

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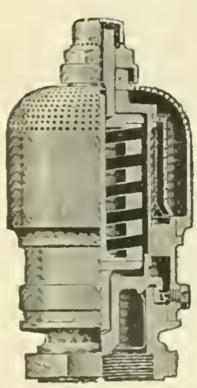

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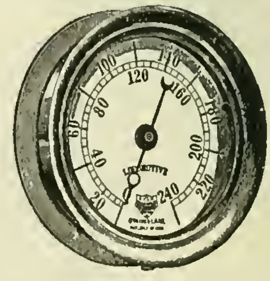

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Air-Brake Catechism. Conger. 1895. This is Conger's "Air-Brake and Signal Instructions" rewritten and improved, containing the air-brake and signal instructions approved by the Master Car Builders' and Master Mechanics' Associations; also the standard list of questions for air-brake instruction. This is the latest and best book on air brakes. Issued November 1, 1895. Price..**25c.**

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Ways and Means. For metal workers, model makers, watch and tool makers, jewelers, draftsmen, etc. This book is written by our correspondent, A. H. Cleaves, and in it will be found illustrations and descriptions of many approved devices which are used in watch factories and other shops to facilitate tool making and other manufacturing operations. Very many things will be found in it of great value to every machinist, tool maker and draftsman. 158 4½ x 7-inch pages; 126 illustrations. Price..**$1.00**

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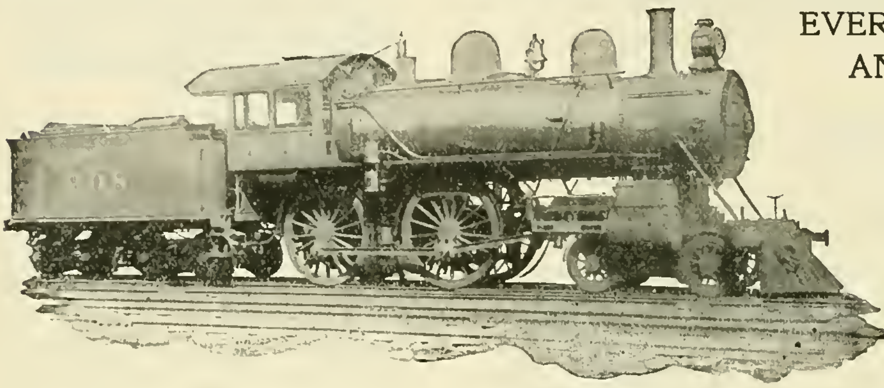
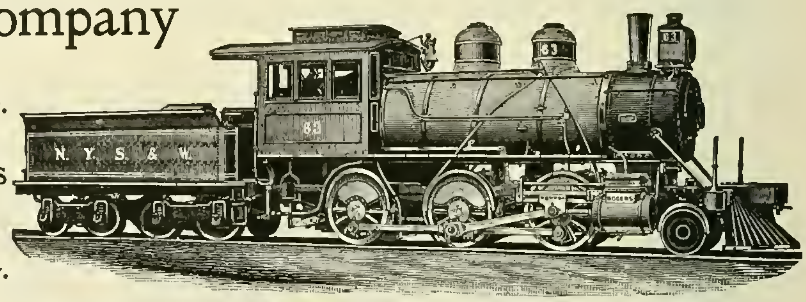
These three books should be in every library and reading room.

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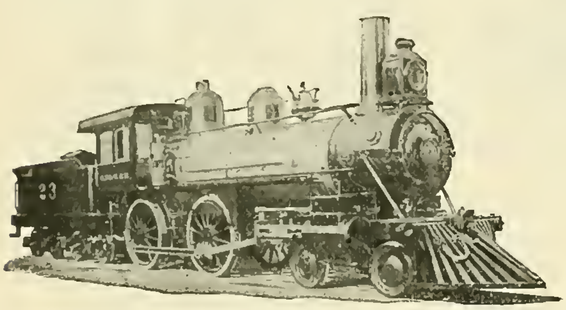
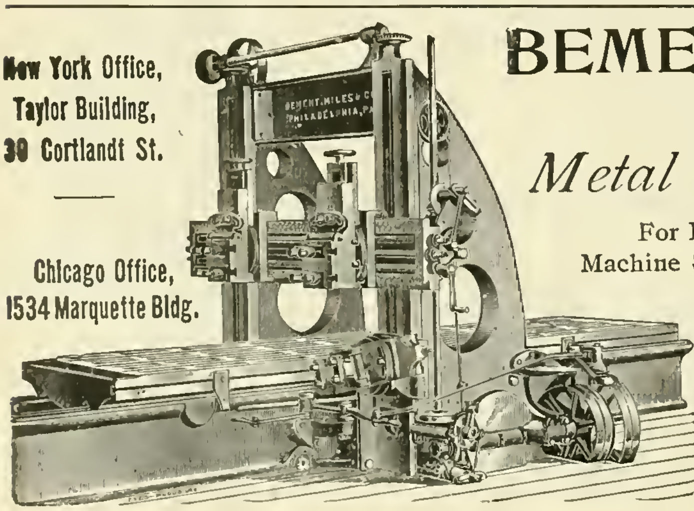




LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

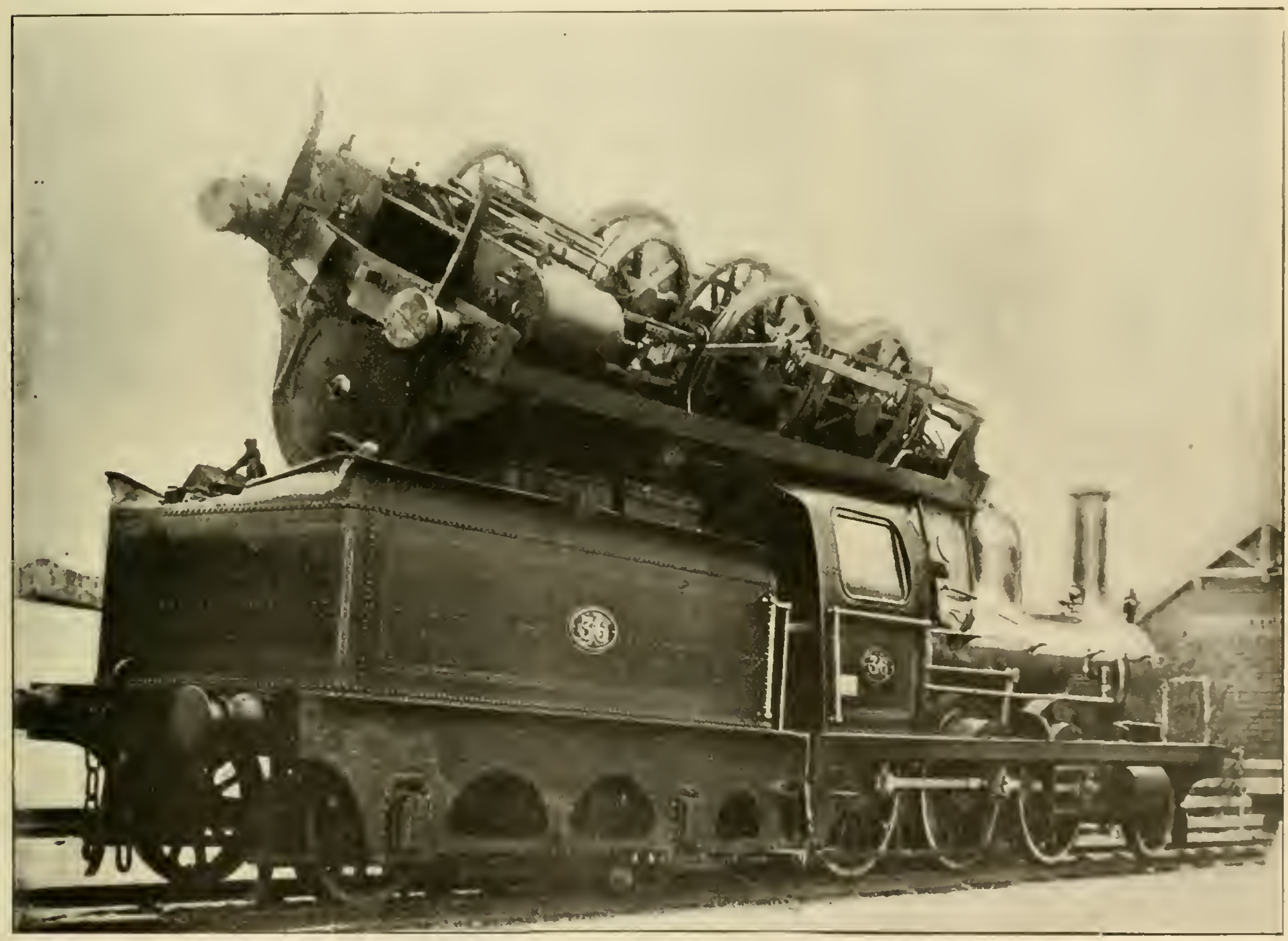
[Trade-Mark Registered.]

Vol. X. NEW YORK, JUNE, 1897. No. 6.

Result of Boiler Explosion.

The curious accident illustrated herewith, where one locomotive was thrown down upon the top of another one, was caused by a boiler explosion. The engine was standing in the same position as engine "36," i. e., end to end, when the boiler exploded and it was turned completely over and landed in the position shown in the photograph.

It was afterwards transported twenty miles back to the shop in the position shown. At the time of the explosion there were two men on each engine, and all escaped without injury. The accident happened four years ago near Christiania, Norway. We are indebted to Mr. W. J. McCarroll, of Philadelphia, Pa., for photograph and account of the accident.



CURIOUS RESULT OF A BOILER EXPLOSION.

A correspondent wants to know where he can obtain benzine paste for boiler-head polish. If any of our readers can furnish us the information, we will be glad to send it around the world.

Jim Skeevers' Object Lessons.

Skeevers Runs Up Against a New General Manager—Fallacies About Upsetting Staybolts—How to Keep the Standard—Some Advantages.

BY JOHN ALEXANDER.

You remember I told you about Skeevers' staybolt improvements a long time ago. Well, Skeevers has had trouble since then.

The first off everything went well. Skeevers captured all the staybolt taps on the system, and sent the new ones in their places. All the bolts were made at headquarters and the subject seemed settled, and settled right.

But one morning last winter an engine came out of the house draped in black and white. Soberly, solemnly, slowly, silently it took its place on the turntable, and as slowly and silently moved down the yard.

Another and another draped in the same way crept out into the daylight and the cold and moved away.

There's always something funereal-like and solemn in a draped engine by daylight, and something weird and uncanny and ghostly at night.

The "old man" had been promoted. The genial, bluff, honest old general manager had had a tussle with pneumonia and been defeated.

Like many another man, he was a martyr to his inherent desire to lead. He went out with a snow-bucking brigade and met the enemy.

There was genuine sorrow on the road —a friend had gone—the engines wore their weeds for the regulation thirty days, he always liked to meet a mechanic, was a mechanic himself, graduate of Slightem, and asked Skeevers what "tech." he graduated from.

Skeevers pointed to a long freight train that was toiling up the grade just beyond the shops and the long line of narrowing ribbons of steel that stretched away toward Granger and the setting sun, and remarked laconically "That." The new G. M. just gave him one of those "Oh, you poor, ignorant cuss!" looks and turned away. He never asked Skeevers' advice on things mechanical after that—he advised Skeevers—or oftener ordered this or that done, without consultation. This made Skeevers itchy; if Mr. Wider had been there he would have demanded his engine back, but Skeevers was past that now; he must remain Supt. of M. P. or nothing.

One day, six weeks ago, Mr. Toping—that's the new G. M.—was taking a turn through the shops towing Skeevers in his wake. He was hunting for something to order changed.

Fibers of Iron and Steel," and you will find I'm right. This upsetting breaks the fibers, sir, and makes your larger end actually weaker than the smaller part not so mistreated."

"But, Mr. Toping," said Skeevers quietly, "I have a more recent work on the subject that goes far to disprove the broken fiber theory, and if you will suspend sentence on the whole process until to-morrow I'll show it to you."

"Who's the author?"

"Well, I must confess I have something to do with the authorship."

"You—writing on metals—why, what do you call the book?"

The idea of this ignorant man writing on a mechanical subject sort of took his breath.

"Well, sir, the name is hardly decided on yet; thinking of calling it 'Some Recent Experiments with Staybolt Iron.'"

"Oh, it's only in manuscript yet?"

"Hardly that, sir. If Mr. Wider were alive he'd call it an object lesson. I'll bring it down to you in the morning."

1 2 3 4 5 6

ETCHINGS OF UPSET STAYBOLT IRON.

while all employés, high and low, wondered what the new manager would be like. For, mind you, corporations wear no crape, mourn no dead, nor do they miss anyone very much. In due time a new general manager came on from the East.

He was young for his position, say 35; he was someone's son; he was a graduate of a technical college; he had worked several years as assistant freight agent of a big road, of which his father was a director, and always asked the reporters to mention him as a self-made man who came up from the ranks.

He made a great many people connected with the G. A. L. very tired before he got through with them. Being authorized to put M. E. behind his name, and thinking that the book-cramming of mechanical lore that had been stuffed into him ten years before was better than all practical experience in the world, he bothered Skeevers a good deal.

The first day he came to the shop he shook hands with Skeevers warmly, said

They had got through the blacksmith shop, and the new G. M. M. E. had his hand on the latch of the boiler shop door, when that Acme header of Skeevers' started up. The G. M. M. E. went back to it.

"What have you here, Mr. Skeevers?" he asked.

"A bolt header, sir. We upset these staybolts at the ends so that the center of bolt is a little smaller than the root of the thread; we have to cut less threads, the bolt is lighter, and does not break so quick; besides we have a system of—"

"But, my dear sir," interrupted the manager, "you break the fiber of your iron in this upsetting process; that's bad engineering, sir, bad engineering!"

"It works very well in practice. We have no trouble with staybolts since we have used this system and—"

"Yes, yes; that's all right, Mr. Skeevers, but this is all based on a theory that is radically wrong. You get a copy of "Rodam on the Metallurgy of Metalology," or "Spinkham on Molecules, Globules and

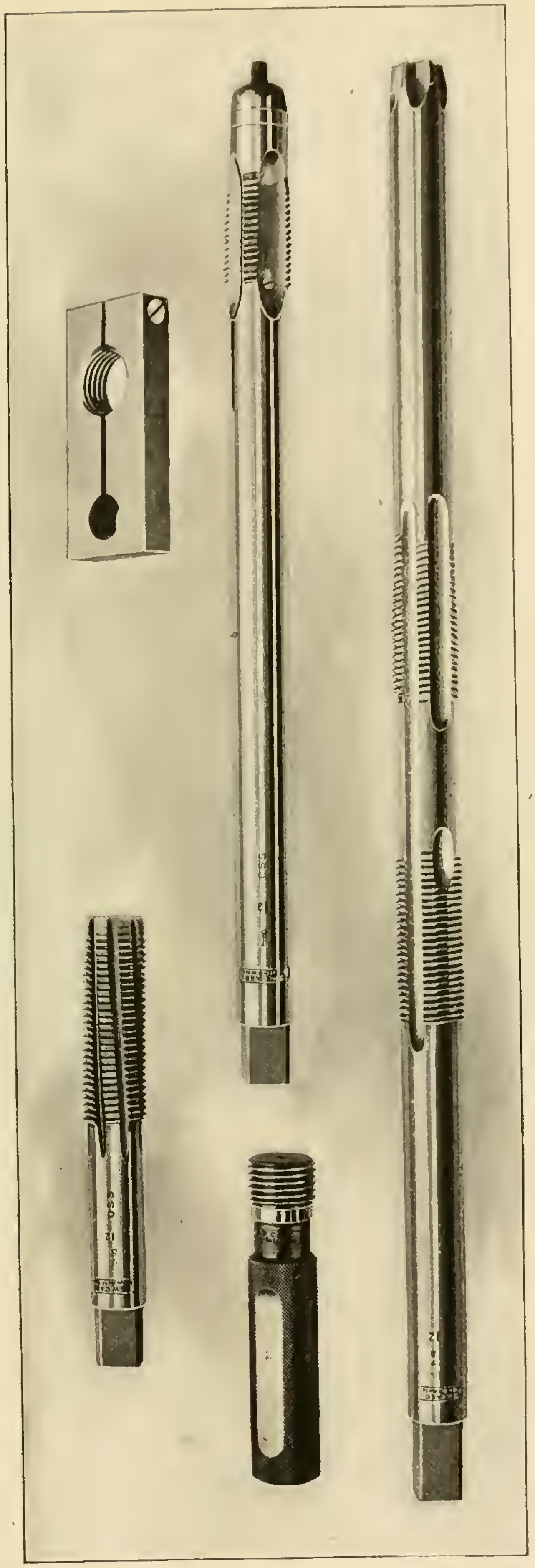
"All right," said the G. M. M. E. as he went into the boiler shop, and in his mind he pictured how bare and poverty stricken and un-influential a title page would be without a list of colleges and professorships and association symbols following the name of the author. How dare a man do it?

Once rid of his visitor, Skeevers went right back to the smith shop, he sorted out several pieces of staybolt iron himself, marked them, had each one heated as he wanted it and headed them up in the machine.

He carried them himself to a planer hand and had them carefully planed half in two and polished, then he took them to old Jimmy Simpson in the tool room and went to his office.

That evening old Jimmy left a package on Skeevers' desk, and Skeevers took it home, and the next morning he put it into his overcoat pocket and went down to the general office.

Mr. Toping was anxious to see Skeevers. The fact that Skeevers, his master



TOOLS FOR STANDARDIZING STAYBOLT WORK.

mechanic, was liable to write a book on metalology seemed to impress him, and, truth to tell, he hardly knew whether Skeevers was about to make a fool of himself or be admitted to the circle of immortals who write technical books, but he leaned strongly to the fool theory.

Skeevers unrolled his samples of staybolts and, with a twinkle in his eye, said:

"Mr. Toping, this in my 'book'—just a practical demonstration about that fiber theory propounded by you yesterday. I must confess I could not answer you then, for I did not know. But, sir, this is an important matter, one on which my reputation and yours, the reputation of the company and the possibility of its losing lots of money on a misjudgment depend. We can't afford to be wrong, sir."

"Very true, Mr. Skeevers, but——"

"This," said Skeevers interrupting, "will, I think, settle that question. These experiments cover all the irons we can use and all the ways we can upset it; now you be the judge."

"Now, sir, after you went away I personally collected these specimens and saw the work done. This specimen numbered 1, both on the bolt itself, and this print taken from the face, was etched on a bolt of Taylor staybolt iron upset with one blow at white heat—our regular practice. No. 2 is Taylor iron upset with four blows at a dull red heat. No. 3 is U. S. iron upset with one blow at white heat. No. 4 is U. S. iron upset with four blows at red heat. No. 5 is common iron rod upset in our new box dies with longer fillet—an improvement in shape—upset at white heat. No. 6 is common iron not upset."

"Now, sir, in all these cases it was necessary to rust these specimens in order to show the fiber. I don't think you can find any evidence whatever of a broken fiber in any of these bolts."

Skeevers glanced at the G. M. M. E., but there was no sign of a give in—he himself had said it, and if those fibers had not broken so much the worse for 'em.

But Skeevers is a tactful man and he was beginning to understand the weak places in the G. M.'s armor. He couldn't be made to own up and give credit as Mr. Wider could; he would never pat Skeevers on the back or brag on him if he ran the engines ten miles on a pound of coal. Skeeves aimed lower, and before his opponent could fire a shot.

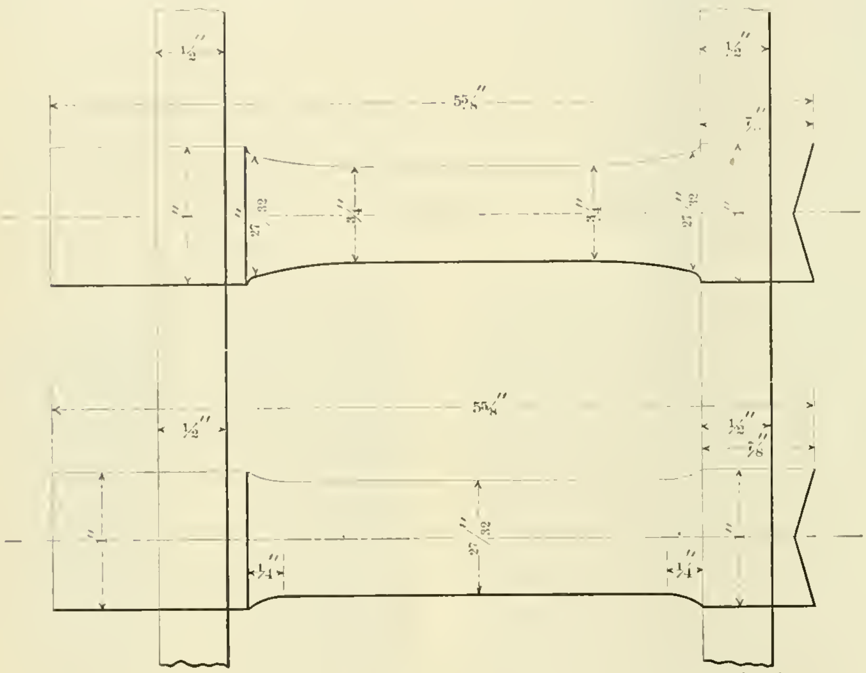
"I met Mr. Dix, superintendent of the Mathematical Bridge Works in the car coming down this morning and asked him if they used upset threaded ends for truss rods, etc., in the best work, and he says they don't use anything else. Mr. Dix is a graduate of the Slightem Polytechnic—the G. M.'s alma mater—and says that Professor Thrashem made some experiments three years ago to test the strength of such work and was so impressed with its value that he has prepared a paper on the subject to be presented to the British Society of Mechanical Superiority, which will afterward appear in book form."

The cloud on the brow of the G. M. M. E. cleared up.

"I'm mighty glad to know that," said he, enthusiastically; "leave Professor Thrashem to find out the truth. If he says that upset ends of bolts under tension are correct it would be idle to dispute it—they are all right, go on and make 'em, its undoubtedly a new step in engineering."

"And beside, Mr. Skeevers, my clerk has been telling me about your staybolt work and showed me the article in 'Locomotive Engineering' about it. It is a good thing and as nearly perfect as anything I have found here. Go right ahead and carry it out strictly to the letter—I believe it's perfect. Good morning."

Such praise was praise indeed, and Skeevers whistled softly to himself all the way back to his office, stopping once in a while to say in a whisper, "Nearly perfect; I believe it's perfect;" then he whistled again. Queer chap, is Skeevers.



Locomotive Engineering

TWO FORMS OF UPSET STAYBOLTS.

When Skeevers sat down at his desk the first thing that met his eye was a letter from Owens, at Granger, saying they were in trouble about staybolts for the 218. After some preliminaries he wrote:

"I think the trouble is in the cutter; the bolts are larger; they can be forced in with a 20-inch wrench, but it's work. Evidently the test plate with hole tapped by standard tap is worn by constantly screwing bolts into it, and has allowed the operator to let his dies wear large—what shall we do?"

Skeevers wired Owens to wait until he came down, as the 218 was in no hurry, and went home wondering what was wrong with his "perfect" system.

Before Skeevers could go to Granger he was called East by a death in the family, and while in New England made up his mind to see a few men and a few shops he had long wanted to visit.

It so turned out that within a week from the time the G. M. M. E. had pronounced Skeevers staybolt scheme "perfect" that Skeevers climbed the stairs in the old stone office of the B. & A. at Springfield, Mass., to make the acquaintance of the Supt. of R. S., Thomas B. Purves, Jr.

Mr. Purves was in the midst of a pile of interchange repair bills and cigar smoke when Skeevers' card was put on his desk.

"James Skeevers, S. M. P., Great Air Line—show him in!" said Purves, going to the rail to shake hands with his visitor. "Say, Skeevers, seems as if I had known you for ten years; been reading about you, and—how's the object lessons?—have a seat—have a cigar."

In ten minutes he was calling Skeevers "Skinny" and Skeevers was calling him Tom, and they were "railroading."

"By the way," said Purves, as he shut off his talk to relight his cigar, "I adopted your staybolt scheme the minute I saw it; best thing I ever saw."

"Well," said Skeevers slowly, "hope you won't be disappointed. My new G. M. says the system is perfect, but I'm not dead sure that he knows. We struck a snag the day before I left."

"What?"

"Bolts wouldn't go into holes. My division man says we've let the bolt cutter die get large, and of course the tendency is all that way, but he seems to forget the tendency of the tap is also to wear small. Anyway they are off, and the 'perfect' system needs perfecting."

"We've been all through that and have it down to a nicety—I'll show you."

Purves pulled out some drawings.

"Well, here's a picture of my taps and gages. I don't happen to have a set here, but now, just as you say, the tendency is for the hole to become smaller from wear of tap, and the bolt to become larger from wear of die. Here's how we take care of all that.

"In the first place, we provide a standard male gage—shown here at the bottom of picture in center—we'll say this is our set for ⅞ bolts. This plug is hardened and ground 12-threads to the inch, U. S. standard, and gets no wear, for it is only used to test the size of the adjustable female gage, shown in the upper left hand corner.

"This female gage is used to test the staybolts daily, and they must all just screw into it, and it is kept just right by the male, master gage."

"Now, this hob, in lower left hand corner is for truing up the dies. It's plain that by this plan you can keep your bolt output right up to a standard size."

"Here's the staybolt tap, reamer on end to true up hole, cutting threads and the guide threads to enter the outside sheet and insure the threads in the inside sheet being in alignment with those on outside sheet.

"Here's where you are liable to get into trouble—this tap will wear and almost before you know it some outlaying shop has tapped a lot of holes a thousandth or two small.

"We take care of this by our adjustable tap shown in center; we can adjust this to the female die and run it through the sheets to clean up the holes to standard and not stop the work. This is only used after the error is enough to notice and a new tap is asked for at once. If your man at Granger had one of these he could have gone right along, corrected his work, kept to standard and only bothered you for a new tap."

"S. W. Card Mfg. Co.," said Skeevers aloud as he copied the maker's name in his book. "When I go home I'll have a set of those taps and gages or know the reason why."

"Say, Tom," said Skeevers, "I'm going home and tell the general manager that I have adopted Purves' staybolt scheme, and don't you ever tell anybody else you've adopted mine, and don't josh me about object lessons; your full of 'em yourself."

At about this stage of the game they were joined by another master mechanic who had called to pay his respects to Purves. He is one of those self-conscious old fossils that stood well up in his business twenty-five years ago, and can't realize that he is still away back yonder twenty-five long years—one of the kind that calls petrification by the pet name of conservatism.

All the staybolt business from A to Izzard had to be explained to him—he never heard of Skeevers, or the "Locomotive Engineering"—he never reads.

"And you tell me," said he, "that by a cuttin' of these bolts on a lead screw bolt cutter you can get a true thread, and that by a watchin' of all these gages and taps and hobs you can make all the bolts in one shop and send 'em to the other shops and they'll fit, and they'll go in with a little 6-inch socket wrench without squarin' the ends. Well, now, tell me, what ye've saved."

"Trouble," said Skeevers.

"Money," said Purves.

"Well, now, boys, ain't you a settin' up a straw man to knock down? Ain't the old threaded-all-the-way staybolt good enough? Ain't the common bolt cutter and the home-made tap good enough? What's the use in cussin' the hoss that's carried you over the creek?"

"I'll tell you," said Skeevers, "you say you are running 130 pounds pressure yet on a small road using small boilers. Your company sell coal and let you waste money on your engines. We have to watch every cent, have to spend money for these tools to save money in the work and repairs.

"First, we do a better job. Second, we save money.

"We upset our bolts, at first using a straight bolt as shown in this lower cut—what's the use of a staybolt larger than the root of the thread?—this leaves the skin of the metal on, is stronger, prevents rust, and instead of threading 5½ inches of bolt we only thread 2½ inches—less work. We save more than half their cost by cutting them all at one place especially fitted up for it. Now, in this upper cut here is shown Mr. Purves' latest design of staybolt. He retains all the advantages of the first form and saves, on 3½-inch water space bolts three-quarters of a pound per bolt, a saving of 4½ cents each where 6 cent material is used—this is enough to pay for cutting the bolt and tapping the hole. Besides that there——"

Tom touched Skeevers' foot and winked.

Skeevers stopped talking and lit a cigar—the old man was asleep.

Logging Locomotive.

The curious-looking locomotive here shown has been built by the Curtis Manufacturing Company, of St. Louis, for logging purposes, and to run on track where wooden logs are used for rails.

The cylinders are 7 x 10 inches, and transmit power to a supplementary shaft, which carries sprocket wheels that transmit the power to the driving wheel axles by means of chains. The speed at which the engine is intended to work is about 5 miles an hour, and it is said to give very satisfactory service.

NEW FORM OF LOGGING ENGINE.

Whistle Too Big.

Some of the most amusing anecdotes are told about President Lincoln, relating to incidents of his life when he was a young lawyer practicing in the courts of Illinois. It is said that he was once engaged in a case in which the lawyer on the other side made a very voluble speech full of wild statements to the jury. Lincoln opened his reply by saying: "My friend who has just spoken to you would be all right if it were not for one thing, and I don't know that you ought to blame him for that, for he can't help it. What I refer to is his reckless statements without any ground of truth. You have seen instances of this in his speech to you. Now, the reason of this lies in the constitution of his mind. The moment he begins to talk all his mental operations cease, and he is not responsible. He is, in fact, much like a little steamboat that I saw on the Sangamon river when I was engaged in boating there. This little steamer had a five-foot boiler and a seven-foot whistle, and every time it whistled the engine stopped."

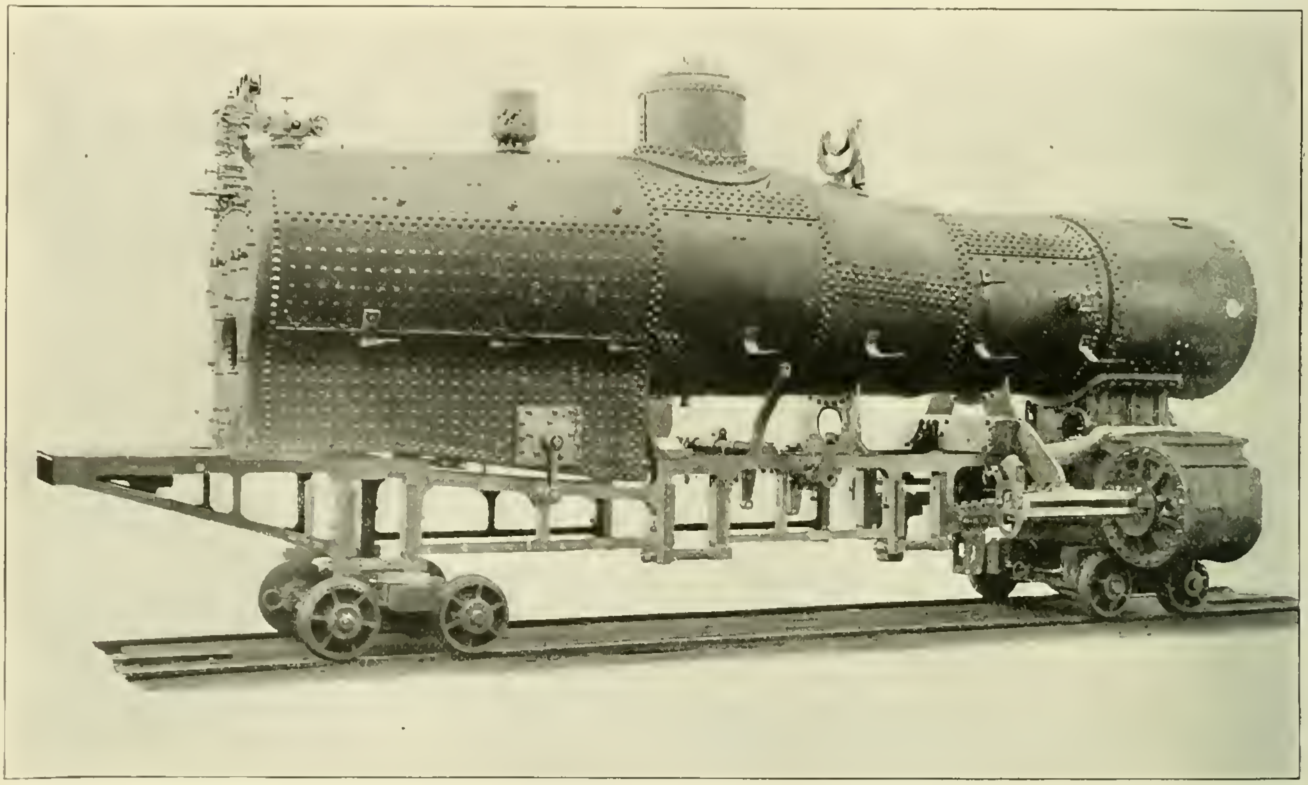
Our Coal Supply.

In an article contributed to the "Tradesman," Frank G. Carpenter says: "There is enough coal in Alabama to do all the manufacturing of the United States for many years to come. I was told at Bessemer that the available coal of Alabama alone, if it could be put into a lump, would make a solid chunk 70 miles long by 60 broad and 10 feet thick. Such a lump would, it is estimated, furnish 10,000 tons of coal a day for more than 11,000 years, or 1,000,000 tons a day for 115 years.

"But Alabama has only a small amount of the great Appalachian coal fields. These fields end somewhere in Alabama. They run from there northward a distance, it is said, of about 900 miles, and they are from 30 to 180 miles wide. They furnish about two-thirds of all our bituminous coal output, and we produce, you know, about one-third of all the coal of the world. In 1894 we mined 170,000,000 tons of coal, while the whole world produced only 570,000,000 tons. The only country which beat us that year was Great Britain."

Northern Pacific Ten-Wheel Engine Boiler.

The annexed reproduction of a photograph gives a striking view of the boiler and frames of a ten-wheel compound locomotive, designed by Mr. E. M. Herr, superintendent of motive power of the Northern Pacific Railway, and built by the Schenectady Locomotive Works. As will be seen from the photograph, the boiler is the extended wagon top type, and is 62 inches diameter at the first ring and is designed to carry a working pressure of 200 pounds per square inch. The firebox is 108 3-16 inches long and 41 inches wide; has a grate area of 30.8 square feet and 168.03 square feet of heating surface. The total heating surface of the boiler is 2,485 square feet.



BOILER OF NORTHERN PACIFIC TEN-WHEELER.

As will be seen from the photograph, the back head of the boiler is decreased in diameter, being 6 inches smaller than at the portion of the boiler where the dome is located. All of the flanging on the boiler, as well as smokebox, front end door, cylinder and steam chest casings, are of hydraulic pressed steel.

Momentous Results from Small Causes.

"On what small causes great effects sometimes depend!" remarks John J. McLaurin, in "Sketches in Crude Oil." "Believing a snake story induced our first parents to sample 'the fruit of that forbidden tree whose mortal taste brought sin into our world and all our woe.' Ambition to be a boss precipitated Lucifer 'from the battlements of heaven to the nethermost abyss.' A dream released Joseph from prison to be 'ruler over Egypt.' The smiles of a wanton plunged Greece into war and wiped Troy from the face of the earth. A prod on the heel slew Achilles, a nail—driven by a woman at that—finished Sisera, and a pebble ended Goliath. The cackling of a goose saved Rome from the barbarous hordes of Brennus. A cobweb across the mouth of the cave secreting him, preserved Mahomet from his pursuers and gave Arabia and Turkey a new religion. The scorching of a cake in a goatherd's hut aroused King Alfred and restored the Saxon monarchy in England. The movements of a spider inspired Robert Bruce to renewed exertions and secured the independence of Scotland. An infected rag in a bundle of Asiatic goods scourged Europe with the plague. The fall of an apple from a tree resulted in Sir Isaac Newton's sublime theory of gravitation. The vibrations of a tea-kettle lid suggested to the Marquis of Worcester the first conception of the steam-engine. A woman's chance remark led Eli Whitney to invent the cotton-gin. The twitching of a frog's muscles revealed galvanism. A diamond necklace hastened the French Revolution and consigned Marie Antoinette to the guillotine. Hacking a cherry tree with a hatchet earned George Washington greater glory than the victory of Monmouth or the overthrow of Cornwallis. A headache helped cost Napoleon the battle of Waterloo and change the destiny of twenty kingdoms. An affront to an ambassador drove Germany to arms, exiled Louis Napoleon and made France a republic. Mrs. O'Leary's kicking cow laid Chicago in ashes and burst up no end of insurance companies. An alliterative phrase defeated James G. Blaine for President of the United States. An epigram, a couplet or a line has been known to confer immortality. A new bonnet has disrupted a sewing society, split a congregation and put devout members on the toboggan in their hurry to backslide. An onion-breath has severed doting lovers, cheated parsons of their wedding-fees and played 'hob' with Cupid's calculations. Statistics fail to disclose the awful havoc wrought in millions of homes by such observations, on the part of thoughtless young husbands as—'This isn't the way mother baked,' or, 'Mother's coffee didn't taste like this!' "

The next annual meeting of the American Society of Railroad Superintendents will be held in Nashville, Tenn., beginning Wednesday, September 22, 1897.

Since the Forth Bridge was built, people in Scotland have been priding themselves on having the longest bridge in the world, but this claim can no longer be sustained, for a new bridge recently built over the Danube is 13,325 feet long, exclusive of approaches, or 2,600 feet longer than the Forth Bridge. The approaches of the bridge over the Danube extend about nine miles over low-lying land, which for several months of the years is completely submerged.

First Railroad Strike on the Continent of Europe.

BY H. GRETENER.

It may interest some of your subscribers to hear of the first railroad strike on the continent of Europe. It occurred in Switzerland on Friday, the 12th of March, 1897, just after midnight, and lasted until the next day, 5 o'clock P. M. The real cause of this strike dates back about a year, when the employés of all the railroad companies in Switzerland prepared to go out on strike for an all-round increase of wages. The companies, in order to avoid trouble, gave in, and, with the exception of one, strictly carried out their promises. The Northeastern Railroad, for economical reasons, tried to ignore the agreement, with the result that finally the men went out on the above-mentioned day, contrary to all expectations, as the company had shortly before nominated a committee to investigate the complaints of the men.

From the minute the strike was declared by the leaders, not a single wheel was turning on the whole system. The company itself was evidently not prepared for such an occurrence, and for that reason had not tried to secure outside help. It was generally thought that the Government would take charge of the company's property and run the trains, as there is a strong feeling in this country in favor of Government railroads. The men themselves were quite willing to take up work under orders from the Government, but it turned out that the latter had no legal right to take such a step. Instead of that, the Federal Government simply sent a delegation, consisting of two federal councils and their assistants, in a special train to Zurich, to arbitrate between the strikers and the company.

This train was taken over the line by an engine and crew of another company. Nearly all the switches on the way had to be set by the crew itself, so completely was the line deserted. The demands of the men were the fulfillment of last year's agreement and the removal of several directors, that were unpopular with the men, from the board of managers. In the ensuing arbitration, the demand for higher wages, respecting the putting in operation of last year's agreement, was granted, but the second demand was refused. Fortunately, both sides declared themselves satisfied with this decision, and word was sent along the whole line to take up work again after an interruption of just forty hours. All this time the men on strike had behaved in a very exemplary manner. No excesses of any kind whatever had taken place. Part of the engines had been kept under fire by them, so as to be ready to start up again at a minute's notice.

I inclose photograph showing the depot at Zurich on the first morning of the strike, one morning train being left on the track without an engine. You notice it looks like a pretty quiet place compared with other days, when over 300 trains pass in and out.

Zurich, Switzerland.

A LABOR STRIKE IN SWITZERLAND.

Bull Holding the Right of Way.

The other evening a bull got loose at Llanfairfechan, and immediately stopped the flow of traffic to and from the station. Taking up his position in the lane leading direct to the station at five o'clock, he defied the utmost efforts of the local police, assisted by many able-bodied young men, either to capture him or drive him from his post up to ten o'clock at night. Passengers arriving at the station between those hours were compelled to sneak ignominiously into the village by pathways surreptitiously gained by climbing over garden walls. In one instance a local editor, accompanied by a local organist, could only get out of the station by walking some distance along the line and then dropping down the embankment into the road. The bull in the meantime kept an equally vigilant eye on the approaches to the station from the town, and some gaily dressed concert parties en route for Penmaenmawr were put to flight. A few daring spirits climbed the iron gate which closed the lane at one end, and attempted to take the bull in the rear, but with an energetic "volte face" and fierce charge he put these to headlong flight. One of them failed to escape out of the enclosure, and only got out of the bull's way by swarming up a lamp-post. There he was besieged for a long time by the bull, who, though he could not get at him, waited patiently for him at the bottom. Eventually the bull was lassoed, and was triumphantly dragged to his resting-place for the night.

Why Ordinary Lanterns Go Out.

The annexed article on lanterns was received from Mr. Willard A. Bourne, of the Galena Oil Works, who conducted a long series of experiments to find out the causes of ordinary lanterns failing to burn. The inventing of the "Perfection" lantern was brought about by the knowledge derived from the experiments:

Signal oil is composed mainly of a combination of carbon and hydrogen. The burning of oil is a chemical action in which the hydrogen is separated from the carbon and both are united in a compound, with the oxygen of the air. The hydrogen, having the greatest affinity, unites first in the colorless part of the flame, and forms vapor or water. The carbon then unites, giving the light, and forming carbonic acid gas. The light is produced by an inside layer of particles of carbon being heated to incandescence, through the intense heat, created by the union of oxygen with the outside layer, in contact. These two products, carbonic acid gas and vapor, at normal, or equal temperatures with the air in contact, are much heavier. The presence of either of these in the air which feeds the light is very injurious, and if in sufficient quantities, will extinguish it.

The ordinary hand lantern has not a sufficient outlet for the products of combustion. In order to guard against being blown out by strong winds, the perforations in the top are made too small. In warm weather, the globe becoming hot keeps the gases up, and the flame burns fairly well, unless blown out.

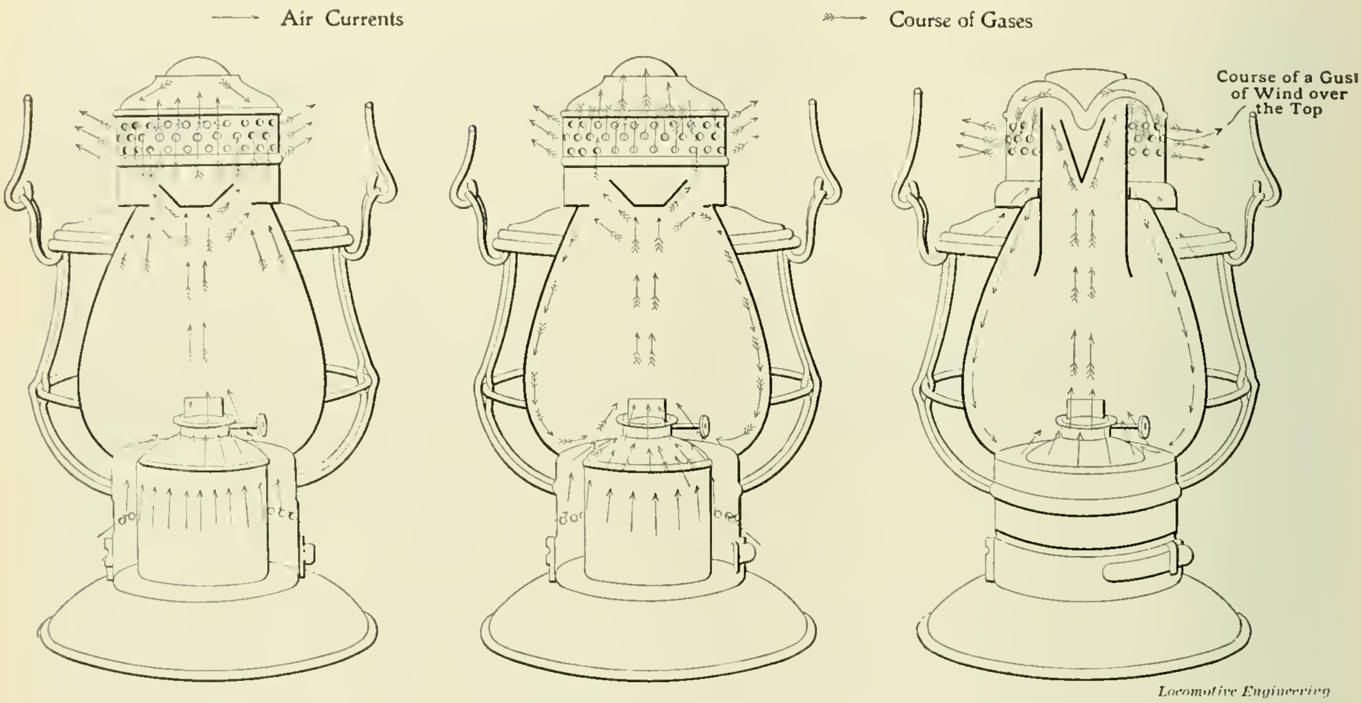
There is little or no difficulty in obtaining a good light in the summer from any lantern when conditions are favorable, but when the cold weather attacks the lantern, and the gases condense inside, then the trouble begins.

The fact that all signal lamps are burned nearly twice as long in winter as in the summer makes a reliable lantern for winter of the greatest importance.

The currents in the regular lantern in winter weather, when the globe becomes cold, differ greatly from the summer circulations. The gases in contact with the upper part of the globe are continually cooling, and form a downward current along the inside of the globe until they join the fresh-air supply, and again go back to the light. The vapor frequently condenses on the globe on its way down, forming what is usually called "sweat." This circulation makes a light very weak, and causes it to crust over more or less rapidly, according to the degree of cold. The colder the weather, the quicker it crusts over. A light under these conditions is always weak, and any motion which will cause these gases to envelop the wick for an instant, will immediately extinguish the flame.

The ventilating holes, as well as inlets, are not protected sufficiently against the wind, and the light, being weak, can be blown out easily. The cause of all this is, first, that the ventilation is not sufficient to carry off the products of combustion as rapidly as they are formed. Second, that there are obstructions in the lantern which completely destroy the initial current given by the light; that the ventilation is but the leakage, through the upper holes, of hot gases, as a result of a slight upward pressure caused by their high temperature. It is evident that when this temperature is reduced the pressure is less. Decreased pressure means slower outlet of gases, or more time for cooling, and consequently greater downward currents and poorer, weaker light.

The slight protection the light has against the wind in the ordinary lantern, though made at a great sacrifice of its efficiency in other ways, is by no means perfect; they all blow out. Another defect is, that the cold air, entering the lantern from below, surrounds the oil pot and absorbs its first warmth from the



Regular Hand Lantern Warm Weather — Regular Hand Lantern Cold Weather — Perfection Hand Lantern Any Weather

AIR CURRENTS IN LAMPS.

oil within. This chills the oil, and very frequently freezes it stiff.

The "Perfection" signal lantern is designed to overcome all these difficulties; it will burn in winter's coldest weather as well as in the fairest summer night.

The chief feature in the "Perfection" lamp is its ventilation. This is designed to give free exit to the products of combustion as rapidly as formed. A cylinder within the perforated top acts as a chimney and conducts the gases to the top. The top is so constructed that it deflects the currents down and out of the lantern through the perforations. A hollow cone is suspended within the cylinder with its apex downward, which gently parts the upward current and at the same time obstructs the passage of any downward draughts caused by strong winds. The rising current does not strike any surface at right angles, but is deflected and preserved until it is practically outside. It is absolutely impossible to blow the light out through this vent by exposure to strong winds. The fresh air is admitted over the top of the globe, through long slots, in a flange attached to the cylinder and resting on top of the globe. These slots cross the edge of the globe and provide openings on the outside and inside, so that the air enters the outside opening, passes over the edge of the globe, and follows down the inside until it reaches the lower part of the globe, where it turns and feeds the light. This draught keeps the globe of an even temperature and prevents cracking. The globe is always covered with clean, fresh air; consequently, there is no fog or smoke on the inside. The fact that the air is introduced at the top makes it impossible to freeze the oil when the light is burning, as cold air never comes in contact with the oil pot.

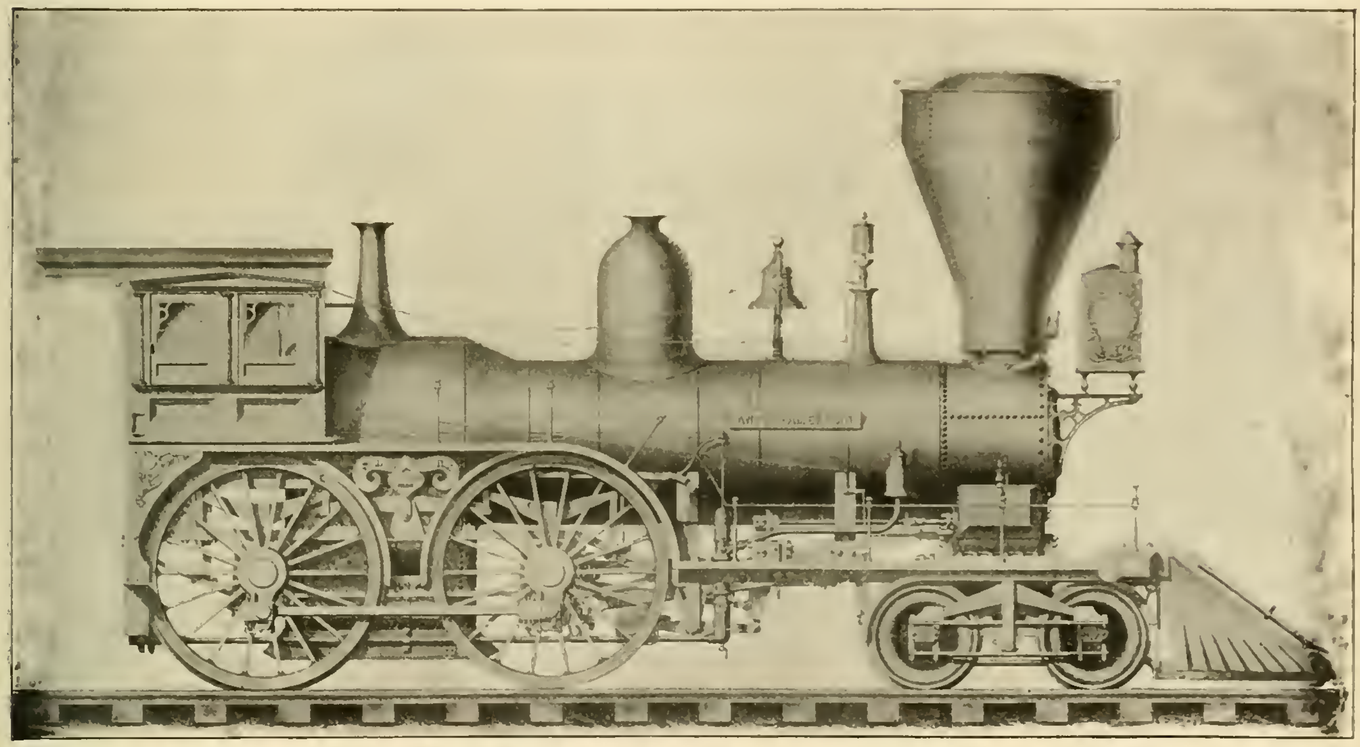
The Bethlehem Iron Company's Works.

About 150 years ago a small band of Moravians, who left their native Hungary because of religious persecutions, came to America and settled in a beautiful valley in Northampton County, on the banks of the Lehigh River. They were a highly pious, strife-abhorring people, and their greatest earthly ambition was to till their farms in peace. Taking the New Testament as their code of moral behavior, their rule of life was literally to bear stripes and oppression without offering resistance. They called their settlement Bethlehem. By grim irony of fate, this town, established by people who abhorred war in all its forms, has now within its borders the most formidable ordnance-making establishment on the American continent.

The Bethlehem Iron Company's works, which were originally established to make iron for the needs of neighboring mining and agricultural machinery, have gradually developed until now they are in some respects among the most important steel-making industries in the world. The extent of the works may be understood from the fact that the principal machine shop is over one-quarter of a mile long, 200 feet wide, and fitted with the finest machinery for manipulating iron and steel that ever was put under one roof.

There are a variety of departments in the huge establishment devoted to different industries, but the parts that a railroad man is most interested in are the rail mill and plate-making shop. The rail mill, although a good plant of about 300,000 tons capacity, does not contain any novel features, unless it be that rails 45 feet long, and even 60 feet long, have been rolled in it. The plate mill is an enormous building, 1,900 feet long. The principal part is new and is not yet entirely finished. It is fitted up with the most highly developed plate-making appliances, many of them having been designed by engineers connected with the works, and have perfections found in no other plant. A very striking thing to a visitor is the great variety of operations performed automatically in the handling of material. All the functions of the human hand are performed by mechanism with tons of grip, and the monster touch seems to adjust movements as delicately as a lady's fingers operating knitting needles.

Four open-hearth furnaces, each of 40 tons capacity, are used to melt the steel of fine quality used for plate-making. Within these works the art of iron-making has grown from the crudest methods and means to the highest. When the Bessemer Iron Works were first established, the pig iron was all made in small charcoal furnaces, that produced about 15 tons a week. The pig was then transferred to a puddling furnace and converted into wrought iron by the hot and laborious process of puddling. The converted iron rested upon a hearth and was stirred by heavy pokers, handled by men,



A PIONEER EXPRESS LOCOMOTIVE. BUILT BY SCHENECTADY LOCOMOTIVE WORKS.

till the metal was decarburized, when it became pasty and was collected into balls that were put under a helve hammer to have the slag driven out. From the hammer the iron went to very primitive rolls, driven by water wheels.

The rise to the modern steel plant was a course of evolution which affected a revolution in the business. Mr. John Fritz, in his address to the Society of Mechanical Engineers, states in regard to this: "In order to show what the Bessemer process can do in coal and labor, as compared with puddling, the former can produce in 10 minutes 10 tons of steel ingots, with a consumption of 1 ton of coal. It will require a puddling furnace 10 days, with practically 3 men to produce a like amount of puddled iron, and will require about 20 tons of coal. The puddling is a hard, laborious and exhausting occupation; with the Bessemer, it is care and attention only, but this it must have."

The Bessemer product is not used for making the plates. The open-hearth, regenerated gas furnace used in these works reduces steel more slowly than the Bessemer convertors, but specimens can be tested during the melting process and quantities of first-class iron or steel can be added to bring the mass up to the required standard of purity.

The plates manufactured are of great variety of sizes, but the most notable thing about them is their large proportions. Since the advent of large locomotive boilers, railroad men have sometimes had difficulty in obtaining steel sheets large enough to cover the outside of a firebox without a seam. The Bethlehem people are prepared to end this difficulty, for there are rolls in this mill that can finish plates 128 inches wide and of length beyond the requirements of any boiler.

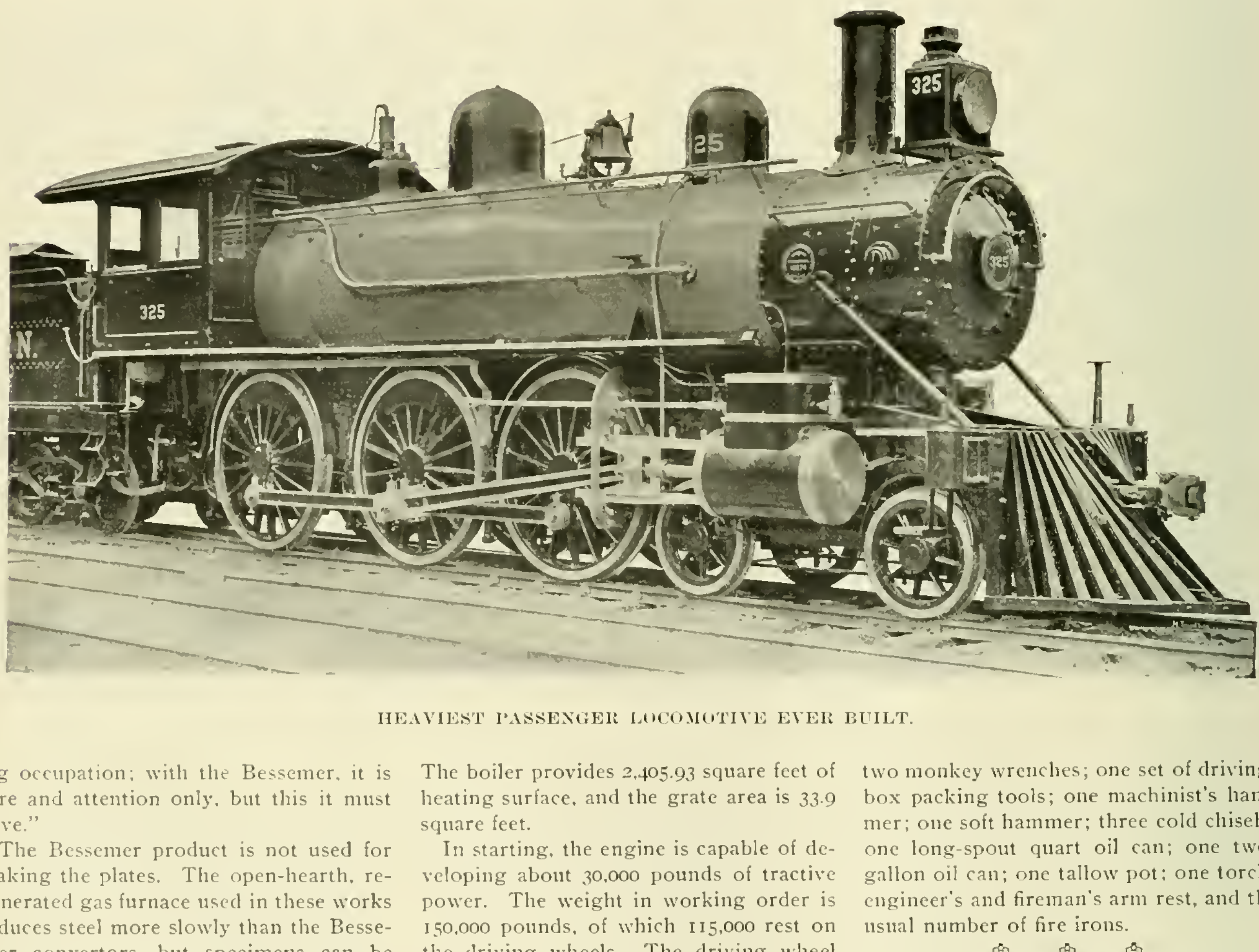
Until this mill was in operation, the Bethlehem Company devoted this part of their establishment to the making of armor plate, but they are now prepared to supply all commercial kinds, and their capacity seems equal to supply the whole country with boiler plate.

Largest Passenger Locomotive in Use.

The handsome ten-wheel engine shown in the annexed engraving was designed by Mr. W. H. Thomas, superintendent of motive power of the Southern Railway, and built by the Baldwin Locomotive Works. The cylinders are 21 x 28 inches, driving wheels 72 inches diameter, and boiler 62 inches diameter at smallest ring. The boiler provides 2,405.93 square feet of heating surface, and the grate area is 33.9 square feet.

In starting, the engine is capable of developing about 30,000 pounds of tractive power. The weight in working order is 150,000 pounds, of which 115,000 rest on the driving wheels. The driving wheel base is 14 feet 5 inches, and the total engine wheel base 26 feet 1 inch. The boiler sheets are 5/8 and 11-16 inch thick. All longitudinal seams are butt-jointed, with double covering strips. Throat sheet is 1/8 inch thicker than shell of boiler. The working steam pressure of the boiler is 200 pounds to the square inch. It will be seen that the boiler is of the wagon-top variety, the crown sheet being supported by radial staybolts, each 1 1/8 inch diameter, screwed through crown sheet and roof of boiler, and riveted over.

The engine is provided with all furnishings that could contribute to the comfort and safety of operating. The pistons are of Peacock brake-joint variety; the crossheads are cast steel with tinned bearings; brass eccentric straps are used, and American balanced valves, with double-relief valves. Steeled cast-iron driving boxes are employed, with brass hub liners to save cutting. The rods have oil cups forged upon them. Two Monitor No. 11 injectors are used and a No. 8 Nathan automatic sight feed lubricator. Engine has Janney couplers on front and rear; has Leach sander, Johann bell ringer and Westinghouse American brake. The furniture of the engine appears to be unusually liberal, consisting of two heavy 24-inch Chapman jacks and levers; heavy pinch bar; complete set of wrenches to fit all nuts and bolts on engines, including two monkey wrenches; one set of driving-box packing tools; one machinist's hammer; one soft hammer; three cold chisels; one long-spout quart oil can; one two-gallon oil can; one tallow pot; one torch; engineer's and fireman's arm rest, and the usual number of fire irons.



HEAVIEST PASSENGER LOCOMOTIVE EVER BUILT.

"Some wise and honored men sometimes do not know what they are talking about, and they talk just as well. Mr. Gladstone has said somewhere that to perfect the locomotive has not required the expenditure of more mental strength and application than to perfect the violin. Still there is hope for the locomotive. It is not yet perfect and is still improving, while the violin has not been improved in a century. More men are to-day tinkering at the locomotive than ever worked at once on the violin.

A New Experience with Electric Traction on a Steam Road.

On the 10th of May an experimental run was made on a branch of the New York, New Haven & Hartford Railroad which, it seems to the writer, marks a distinct step in advance in the handling of suburban traffic.

The New York, New Haven & Hartford Railroad, through the enterprise of its president, Mr. Clark, has taken up the subject of the handling of suburban traffic by electricity a little more enthusiastically than most roads. Mr. Clark apparently recognizes the fact that electricity is here and must be dealt with, and it seems to be his policy to own and control the feeding and competing lines of electric roads that cross or parallel the New Haven.

Last summer the Nantasket Beach road —which is purely a summer affair and runs only three months in the year—was equipped with a trolley. They employed, however, large cars — full-sized open coaches. This line was very successful as far as it went.

Believing in the superiority of the third-rail system over the trolley, the New Haven people put down an experimental piece of third rail, about a mile long, at the end of the Nantasket road. This worked successfully enough during a few trials to encourage them to try something larger.

During the past winter they have built at Berlin, Conn., a very large power-house, and have laid a third rail on the line of the steam road from there to New Britain, a distance of three miles, and from New Britain to the city of Hartford, a distance of nine miles, over the old New England Railroad.

This third rail is constructed in such shape that it sheds water. It is more or less oval on top and concave underneath. It practically rests on the ties, small wooden blocks only holding it up one inch, and is without other insulation. This is something that the electricians all said could not be successfully done. The fact of the matter is that dry wood is a very good non-conductor, but what the leakage on such a line as this will be in wet weather and winter, remains to be seen; but from experiments so far it seems that it will not be nearly so great as was anticipated.

One of the chief obstacles always urged against the handling of suburban business of a heavy character by electricity has been the belief of electricians and railroad men as well, that it was practically impossible to send a current strong enough to run big motors at a distance exceeding five or six miles without heavy and expensive feeders along the line at intervals. This the New Haven people have proven to be not altogether true. On the twelve-mile line just mentioned, they simply connect the third rail directly with the generator at the power-house, and there is no feeding whatever except through the third rail, which, of course, is very large and can carry a large current.

The cars have cast-iron shoes underneath, which rub on the rail, and are equipped with air brakes, the air being pumped by an electric pump. Each platform of the car is equipped with the controlling apparatus of the motors, the air-brake, whistle and gong-bell.

On May 10th an invited party of railroad men, numbering about seventy-five, was taken over this line, although the whole structure from the power-house to the track equipment was in a half-finished state. It is only fair to say, however, that the trip was entirely successful; that the cars fully loaded will accelerate very quickly, and would probably get into a speed of fifty miles an hour in a quarter the distance that would be required by a locomotive and one car. A speed of sixty miles an hour was easily obtainable and was obtained, but numerous grade crossings prevented a continuous run at high speed. The trip from New Britain to Hartford, nine miles, was made in 13½ minutes from start to stop.

It may be that all this does not mean a great deal, but it seems to the writer that it does. In the first place, it is the first experiment of any magnitude where direct current without feeders has handled heavy traffic for as great a distance as twelve miles; in the second place, it demonstrates that one of the great advantages of the electric car over the locomotive is the speedy acceleration, and in the third place, it is the first instance in this country where the electric motor has taken the place of steam engines on their own track.

It may be that the cost of doing business in this way will be greater than by locomotives, but it looks very doubtful. It may be that the leakage from this unprotected rail in bad weather will cost an awful lot of coal at the power-house.

It may be that the bond between the rail joints, which is now made of copper cables bolted to the iron rail, will in time corrode: it is altogether likely that it will, and, as is well known to mechanics, all oxides are very good non-conductors, and this will make the resistance on the line very great.

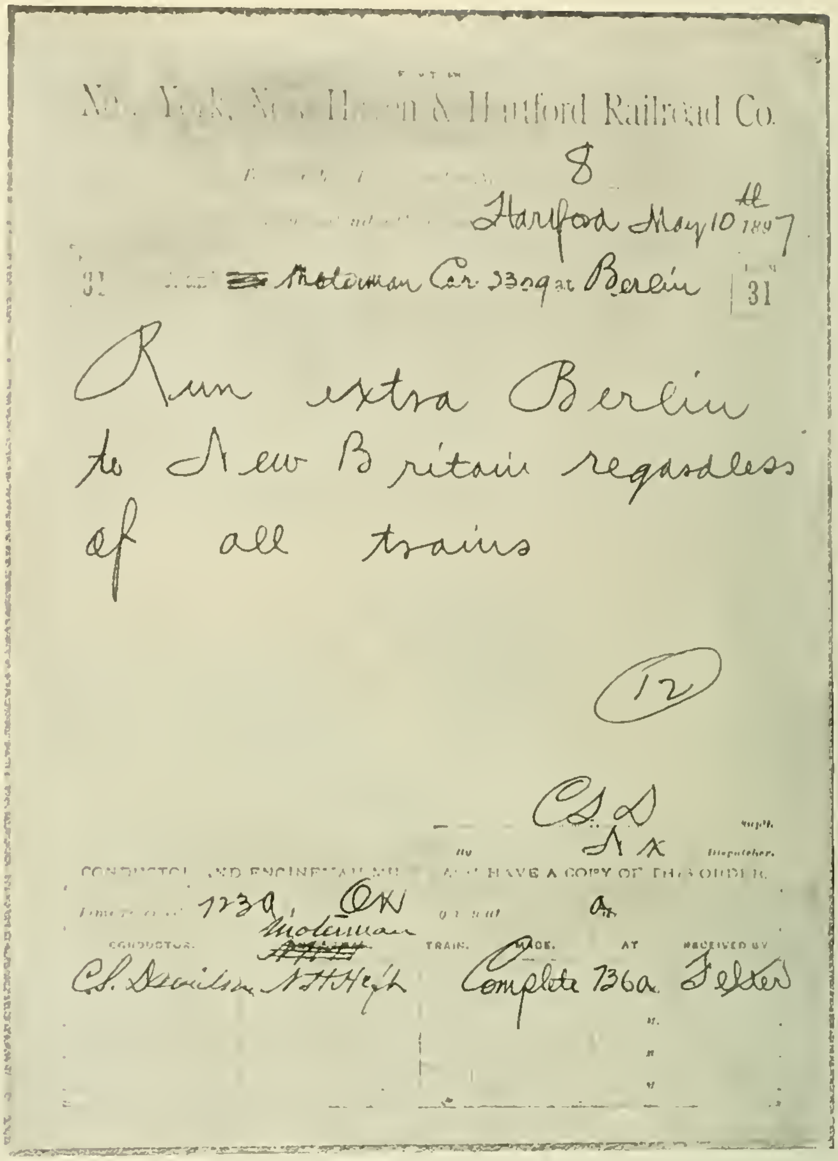
It is perhaps greatly to the advantage of the science of railroading that Mr. Clark and his associates were not deterred

ELECTRIC TRAIN ON STEAM RAILROAD.

by opinions as to what this or that would do under the circumstances, but after making some rough preliminary experiments they showed that they could do certain things that have been deemed quite impossible, and have done them on a scale that will demonstrate their practicability or utter impracticability.

It seems to the writer that the greatest difficulty that lies in the way of the use of the third rail is the danger of connecting this rail with one of the other rails of the track, forming an arc that is very dangerous. This was demonstrated to us, with a little fireworks, at a switch when coming out of the New Britain yards. These cars are equipped with iron pilots, the same as locomotives, and in leaving the yard the forward end of the car was raised on the inclined track and the back end was depressed enough to let the bottom of this pilot rest for an instant on the third rail, and one of the other rails, making a great deal of noise and showing a lot of blue fire. In fact, if a piece of iron, like a crow-bar, was left on these rails, the bar itself would be melted down at the point of contact, and the flames would be very fierce and very dangerous. Just think of the possibilities of such an act on the part of a trackman, or the Fourth-of-July display that would follow if a farmer allowed a chain to drag behind his wagon in crossing the tracks. The only safe way for an affair of this kind to be conducted would be to put the third rail only on the company's absolute right of way, where, by no possible means, could anything get to it.

But this is only one of the small objections. This rail, or its equivalent, might be made into a trolley overhead, and be comparatively safe. The important point is that this work has been done by electricity, done well, and, for some reasons, done a good deal better than it can be done by locomotives.


New York, New Haven & Hartford Railroad Co.

8

Hartford May 10th 1897

31 Motorman Car 3309 at Berlin 31

Run extra Berlin to New Britain regardless of all trains

12

C.S.D.

A.X.

Supt.

Dispatcher.

... HAVE A COPY OF THIS ORDER.

1230 OK

Conductor. Motorman

Train. Made. At Received by

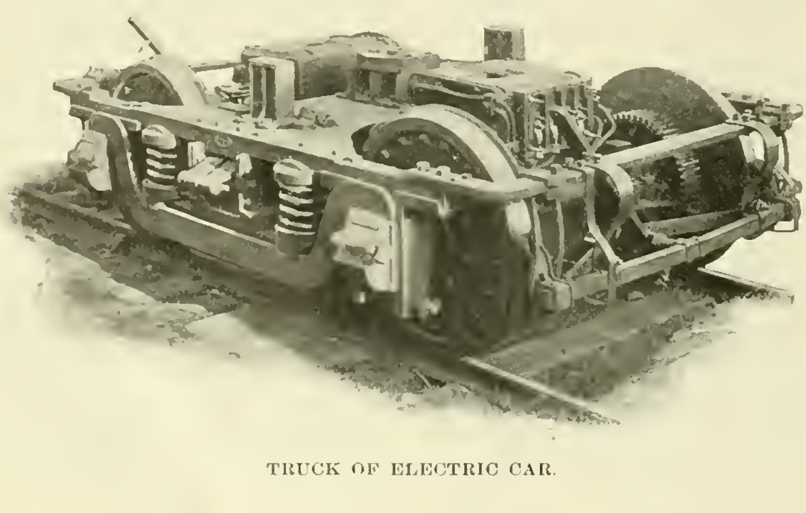
C.S. Davidson NHHeyt Complete 136a Felter

FIRST TRAIN ORDER TO A MOTORMAN.

It would seem that the use of electricity for heavy suburban traffic out of our large cities, and the opportunity it gives for running small, frequent units at good speeds, would give it advantages over the ordinary suburban train. For the same expenditure of power and labor, much more frequent service could be given, no heavy locomotive is pounding over the track carrying its load of water and coal, and the fuel used to do the work could be of much cheaper quality and used under boilers possessing the highest advantages and with condensing engines using steam the most economically.

But the plan of using electricity for trunk line business, or for any heavy service such as is ordinarily found on our American railroads, seems to the writer to be just as far away as ever.

It is all right for a car or two, but has no business—in its present shape—with trains.

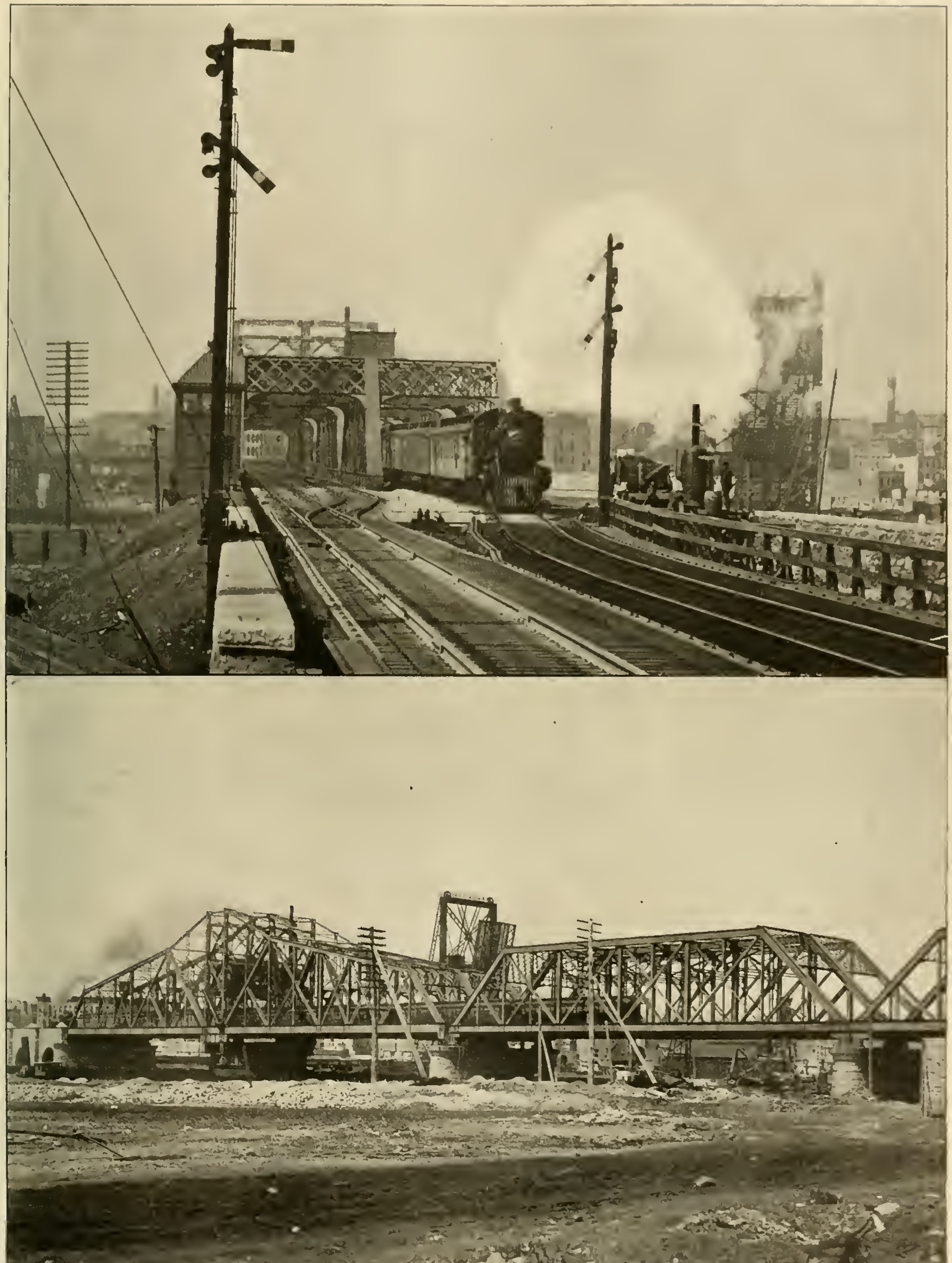


TRUCK OF ELECTRIC CAR.

Planer Parallel Strips.

A very neat way to overcome the weight of large parallel strips used on lathes and planers, and make them much more convenient and safe to handle, besides saving no small item of expense, is to core them, leaving ribs and sufficient thickness of wall to withstand bolt strains without deformation.

The parallel strip is the mainstay of a planer man; without it the handicap is a serious one; and they should therefore be gotten up as light as is consistent with proper strength for their work. The Chesapeake & Ohio shops at Richmond, Va., have these strips to perfection.



HARLEM RIVER BRIDGE.

Harlem River Bridge.

The annexed engraving illustrates the very handsome four-track bridge recently erected over the Harlem River, in the upper part of New York City. Ever since the New York Central Railroad was opened, there has been a great deal of annoyance from delays caused by the swing bridge being opened to permit the passage of tugs and other small craft that had upper works too high for the low bridge in use.

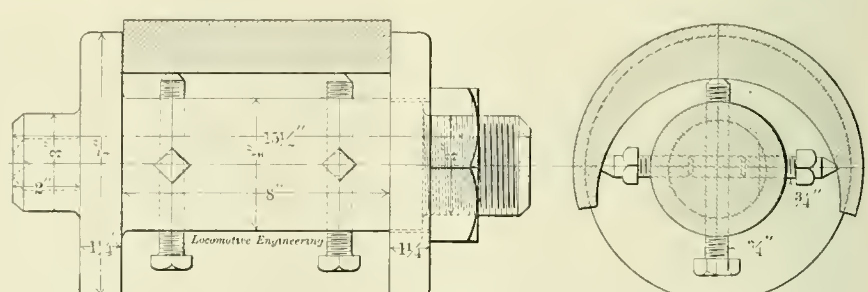
The purpose of putting up a new bridge was to raise the track so that there would be more clearance for vessels passing below. The hight from the bottom of the girder to high water mark is now 24 feet, which allows the greater part of the crait to pass without the draw being opened. The bridge is what is known as pin connected swing of the Pratt type. The power for turning the draw and for raising and locking the ends is furnished by two 50 horse power oscillating steam engines. With this power, the time for opening or closing the bridge is only 1½ minutes. The bridge is very handsome in appearance and is quite an ornament to that part of New York City where it is built.

The Cincinnati Southern people are equipping their locomotives with the pilot steel drawbar, invented by Pulaski Leeds, of the Louisville & Nashville. This drawbar folds back when not in use, and obviates the danger from stock being thrown down on the track by the ordinary pushbar, which so often happens. The bar has been put on the market by Shickle, Harrison & Howard, of St. Louis, who have the sole right to manuiacture it.

A Mandrel for Driving-Box Brasses.

It is customary in a large number of railway shops to turn the fit of driving-box brass in the box, and various styles of devices are used for that purpose on the circular brass. Among the best of these is the one herewith illustrated with the dimensions, as seen in service at the Southern Railway shops, which are presided over by Master Mechanic Owens, at Manchester, Va. This mandrel is seen to hold the brass firmly between two collars, one of which is solid with the body, and the other a sliding fit with a dowel to prevent shifting its position when under the strain of a cut.

The brass is adjusted toward the tool by means of two screws which pass through the body and support the brass against the thrust of the tool at the crown.

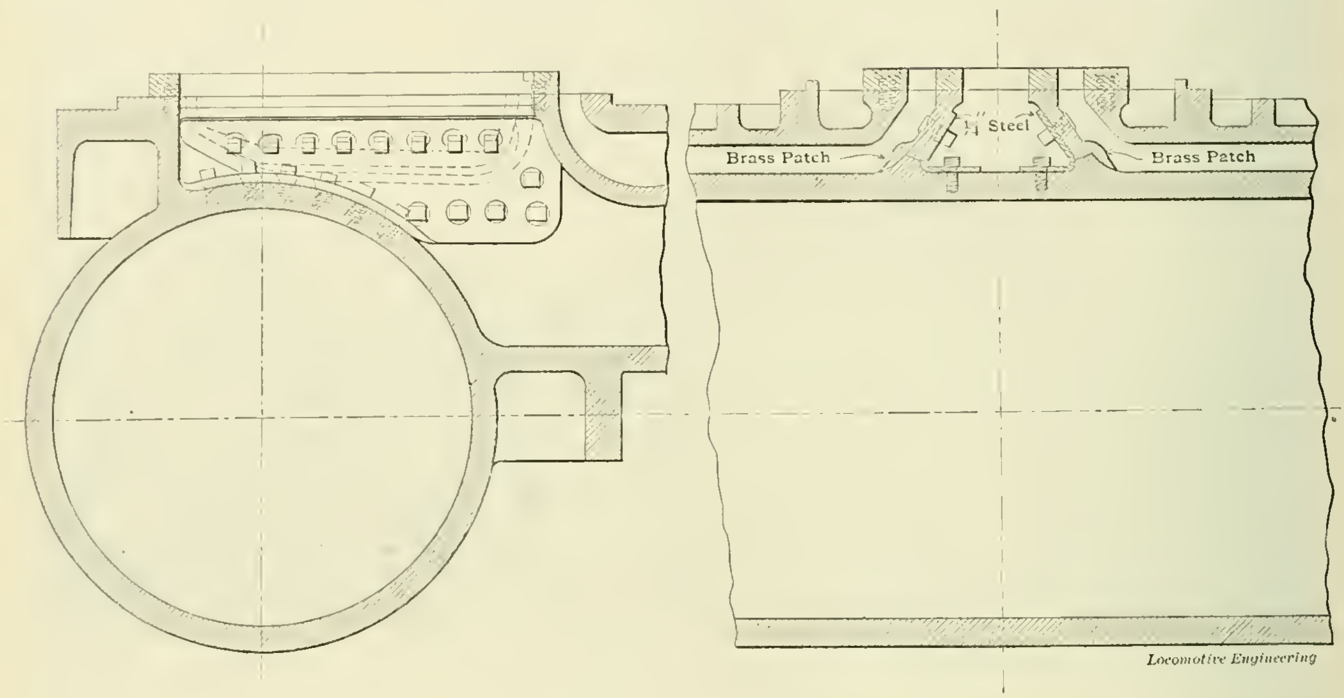


MANDREL FOR DRIVING BOX BRASSES.

Four steel-pointed set screws hold and adjust the brass at the sides, and assist in the driving, the most of which, however, is done by friction between the collars and brass, the set screws being slackened for the finishing cut so as to eliminate all distortion due to springing by the screws' pressure. The threaded end is made long enough to allow the nut to take in all lengths of brasses. This makes a very efficient tool for those who think turning a fit on the brass is preferable to doing the job in a slotter.

How a Valve Seat Was Patched on the Fitchburg.

A 19 x 24 ten-wheeled engine on the Fitchburg Railroad had a peculiar break in the bridges of the valve seat, and the way they were patched furnishes more interesting data on a class of work which demands the clearest mental effort and the highest skill in execution to save the attempt from rank failure.



PATCHED VALVE SEAT.

The engraving shows the two bridges of cast brass, held in place by ¼-inch steel plates and ¾-inch tap-bolts. The old seats having been entirely removed, were replaced by false seats, and these are held in position by four ¾-inch counterbored tap-bolts. The engine has now been in the severest service two years, with both cylinders patched as shown. No signs of weakness have developed up to this time, and the price of two cylinders still remain in the exchequer as a balance against the trivial cost of a good job of patching.

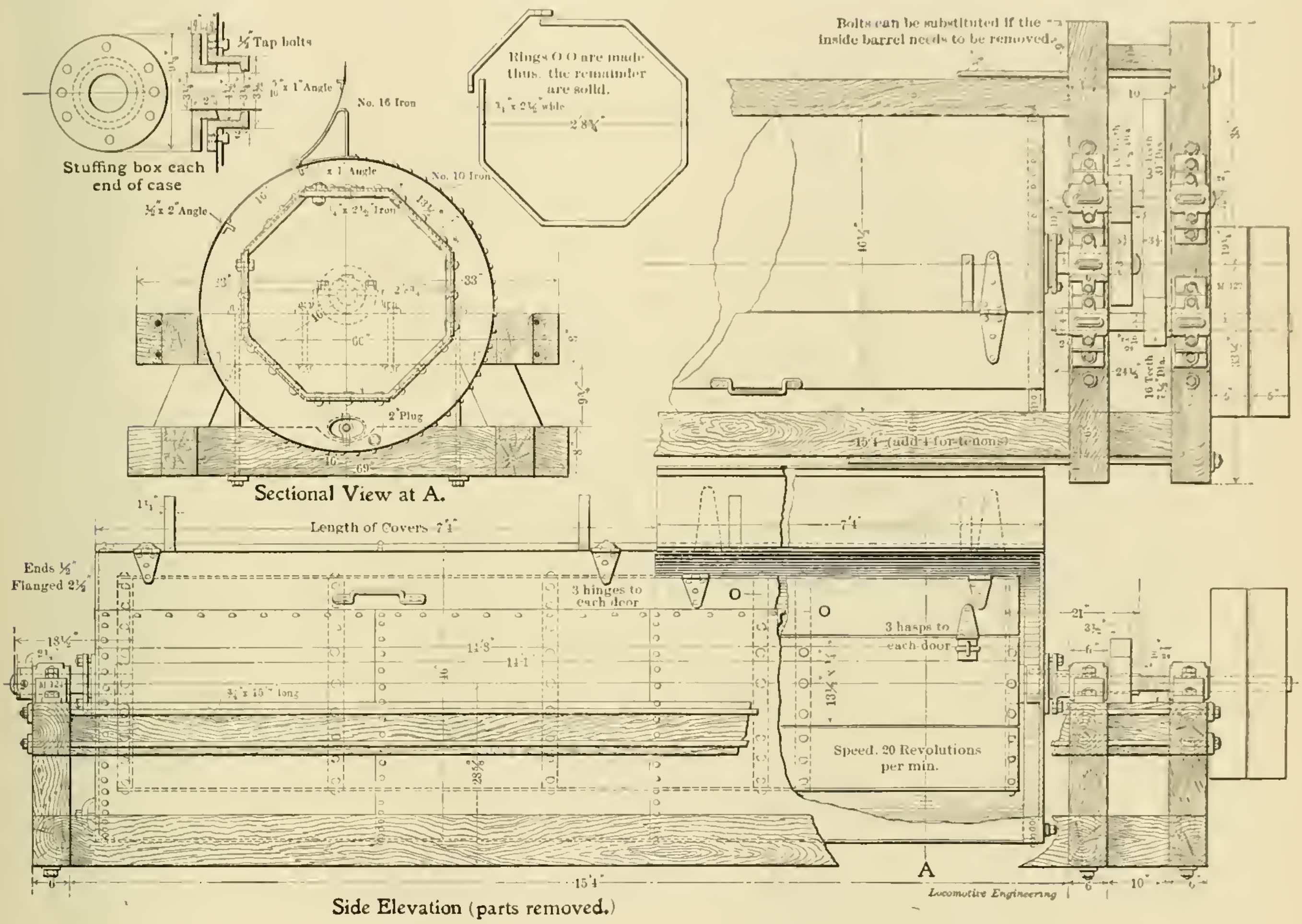
Exception may be taken to a patch of this character on the ground that it is likely to prevent a free exhaust, but, as a matter of fact, it does not affect the exhaust to any noticeable degree, which may be attributed to generous dimensions when designed. It may not be out of place, while on the subject of restricted exhaust passages, to say that we have recently seen several new engines in which the bridges were stayed on both sides by supports cast in the ports, evidently to provide against the contingency which made the patch necessary on the Fitchburg engine.

Submerged Flue Rattler.

The very complete illustration of the flue rattler herewith, was made from the drawings of the New York, Ontario & Western machine, a device which has been a source of unalloyed pleasure to the employés of the Middletown shops since its installation there, for the reason that it is practically noiseless, and, running in water, it is perfectly dustless.

An octagonal box, decidedly open in construction, carrying the flues to be relieved of their scaly coats, and revolving in a stationary cylinder partially filled with water, embraces nearly all of the vital particulars concerning the scheme. It is, in fact, the old profanity provoker with a gag on it, in the shape of the encasing wrought-iron body of No. 10 iron riveted up water-tight, and the whole supported on a substantial wooden frame.

A large pit having connection with the sewer system is under the rattler, into which all mud and refuse from the machine is emptied when desirable to do so, which is a valuable improvement in devices of the kind, as it tends to inculcate an atmosphere of cleanliness on everything around. There is absolutely no dirt about the rig. The machine turns 20 revolutions per minute, and will clean a set of flues in from 12 to 15 hours, leaving the metal perfectly free from scale. The details are so clear that no difficulty will be found in working from the figures in the illustration.



SUBMERGED FLUE RATTLER.

A Fast-Running Mogul.

The mogul locomotives used by the Chicago, Burlington & Quincy for their passenger service appear to be capable of making very high speed, although the driving wheels are only 69 inches diameter over tire. There seems to be emulation between the men running the Columbian engines and those having the moguls, to see which will make the best time on fast trains, and, up to date, victory seems to be in doubt.

About three weeks ago, the Columbian engine hauled a train of five cars 80 miles, from Mendota to Galesburg, in 79 minutes. This was the best record procured for the time, as the best previous speed was 83 minutes. The run was very creditable, for two slow-downs had to be made on the way. One day a week or two ago, one of the moguls took the same size of train the same distance in 79 minutes, so that both types of engines stand equal.

Mr. G. W. Rhodes, superintendent of motive power, writing about these engines, says: "The special feature between our Columbian type of engine and our mogul has not yet been fully determined. In speed, one does not have much advantage over the other. We think, however, that the Columbian engine rides easier, and we hope to show that it is more economical in fuel."

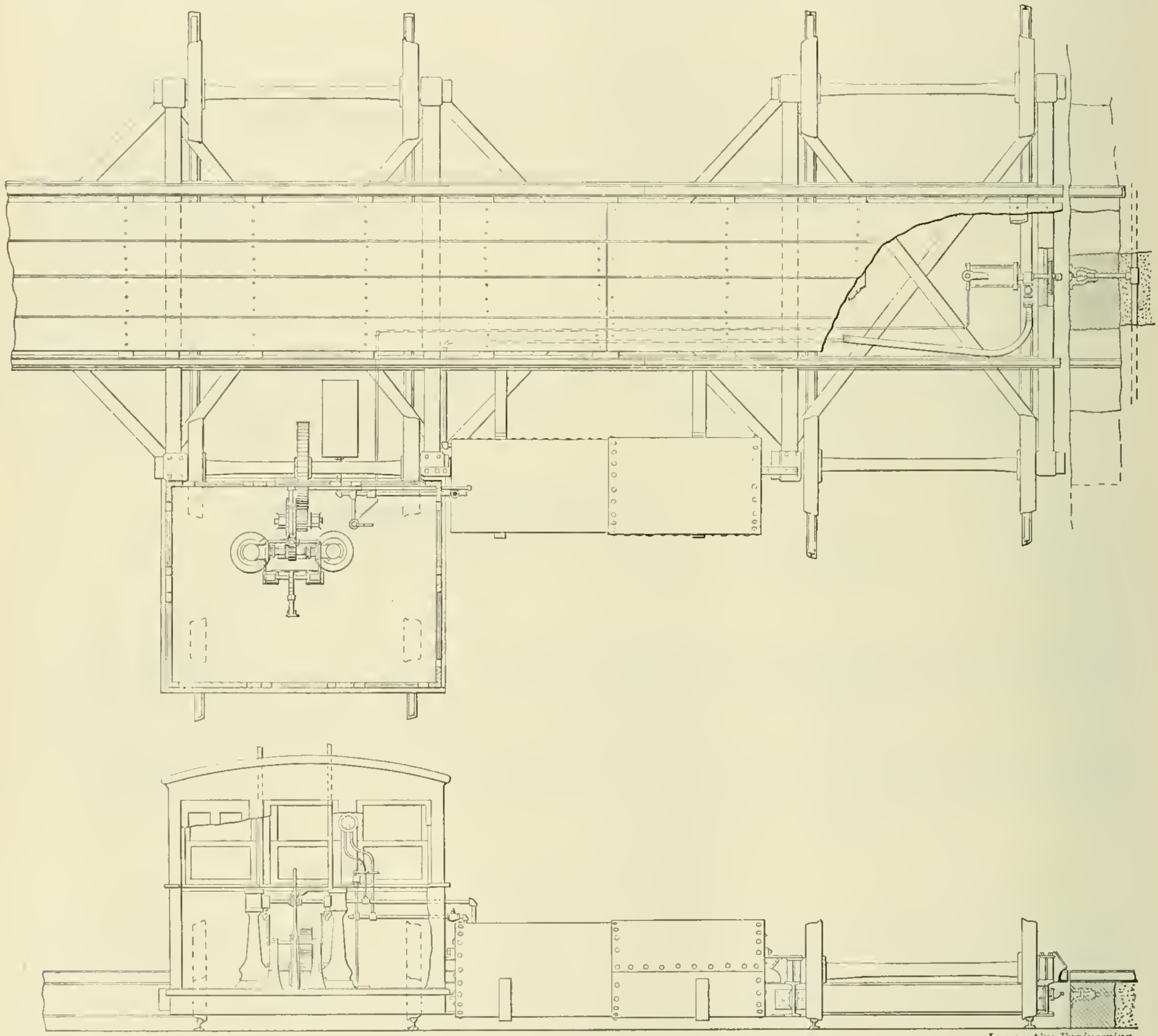
A committee of the Traveling Engineers' Association is investigating "The Care, Maintenance and Economical Operating of Metallic Packing." The subject is well worthy of attention, for it has received very little notice from those who are most interested in keeping this kind of packing in good order.

Transfer Table at Huntington Shops—Chesapeake & Ohio Railway.

The motive power of transfer tables has, within our experience, run a mechanical gamut embracing the muscular energy of the laboring gang, the steam engine, the electric current and compressed air. The latter in its application to the above purpose, appears to be rapidly taking its place as one of the most favorite means of propulsion.

Among the best recent efforts in that planer practice described in our May issue, as well as many other labor-saving tools.

Our illustration gives an elevation and plan of his transfer table at the Huntington shops. The table itself is similar to any other well-designed transfer; the novelties are embraced in the drive and the details referring to same. There are two vertical link-motion engines having cylinders 4 x 4.5 inches, neatly inclosed in a roomy cab, and highly geared to the tubular metallic projection from its center. Let into the coping of the pit wall, and directly in line with the charging cylinder, is the piping and valve containing the air supply from the compressor. This pipe system extends the whole length of the pit, and has a valve between each track connecting with the transfer table. The valve is shown in section in the plan view, also in an enlarged detail, and is seen to have an opening in its outer face, corresponding to the rubber gasket on the



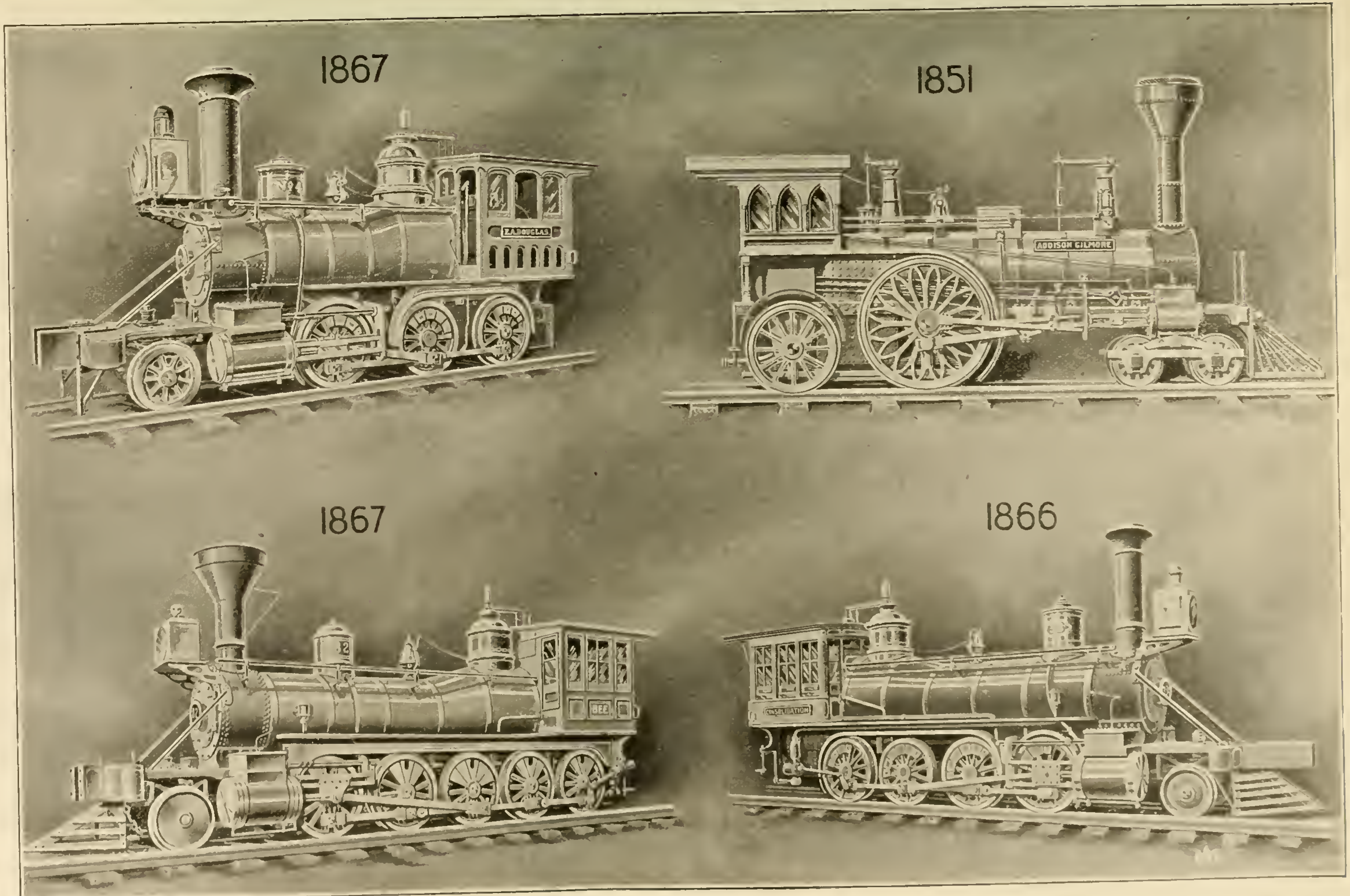
TRANSFER TABLE AT HUNTINGTON, W. VA.

direction, in which the greatest ingenuity and original thought has been devoted to the production of something possessing really unique features, we call attention to those of Mr. A. F. Stewart, master mechanic of the Western division of the above road, whose general foreman, Mr. A. G. Elvin, has added fresh laurels to a well established reputation for original thought in the field of mechanics, by his clever adaptation of air to the transfer table drive. It was he who devised the table, on which is mounted an air reservoir 2.75 feet in diameter by 9 feet long, with a capacity of 53 cubic feet. In the cab is an engineer's brake valve, piped to the engines, and also to the reservoir and charging mechanism.

The charging device consists of a small cylinder placed at one end of the table, centrally between the rails. The piston rod of this cylinder is hollow for a portion of its length, and has on its outer end a spherical rubber gasket with a small piston of the charging cylinder, and also seen to have a small valve opening inward and held to its seat by the pressure within the supply pipes.

In the operation of charging the reservoir (and this can be done at any point within the length of the pit), the engineer's valve is turned to admit air to the charging cylinder, forcing out its piston to a connection with valve of the main

(Continued on page 427.)



1867. First "Mogul." Thomas Iron Co., Hokendauqua, Pa.

1867. First "Decapod." Lehigh Valley Railroad.

GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 6.

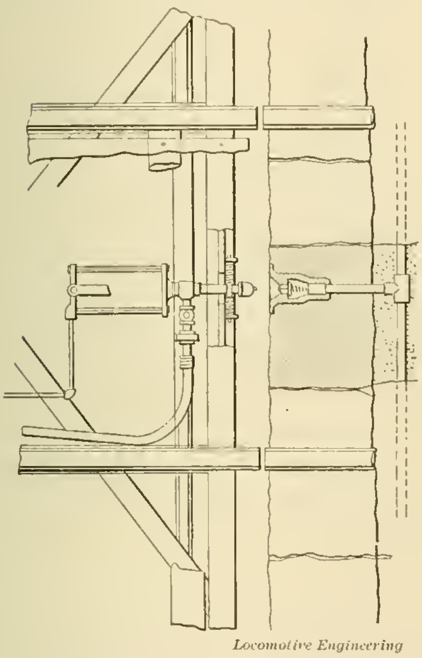
1851. "Addison Gilmore." First with outside oilers, inclosed cab and spliced frame. B. & A. Railway.

1866. First "Consolidation." Lehigh Valley Railroad.

(*Continued from page 124.*)

air supply. While the piston is in this position, the rubber gasket makes an air-tight joint on the face of the valve, and the hollow projection on the center of the piston engages with the automatically closing valve, thus forcing it off its seat, allowing the air to pass from the supply pipe through the hollow piston into the reservoir. A check is shown between the piston and the pipe to the reservoir, to retain the pressure in the latter when air is exhausted from the charging cylinder, in order to break the connection with the main air pipe after charging; the outward closing valve performs a like service for the main pipe at the same instant.

General Foreman Elvin states that his little engines, with their 100 pounds air pressure, will take the table and a 135,000-pound consolidation engine, making a total weight of about 150,000 pounds, and traverse the length of the



VALVE OF TRANSFER TABLE.

pit (which is 250 feet) in one minute and ten seconds. In handling such work as driving wheels, trucks, tenders and coaches, the reservoir capacity is equal to six or eight movements of the table, and when moving locomotives the length of the pit, the reservoir pressure will reduce about 20 pounds.

This arrangement is entirely a home product, designed and built at the Huntington shops. The head-work laid out in perfecting the charging scheme, will be recognized as a fine bit of inventive skill, of which the author may well feel proud.

⁂

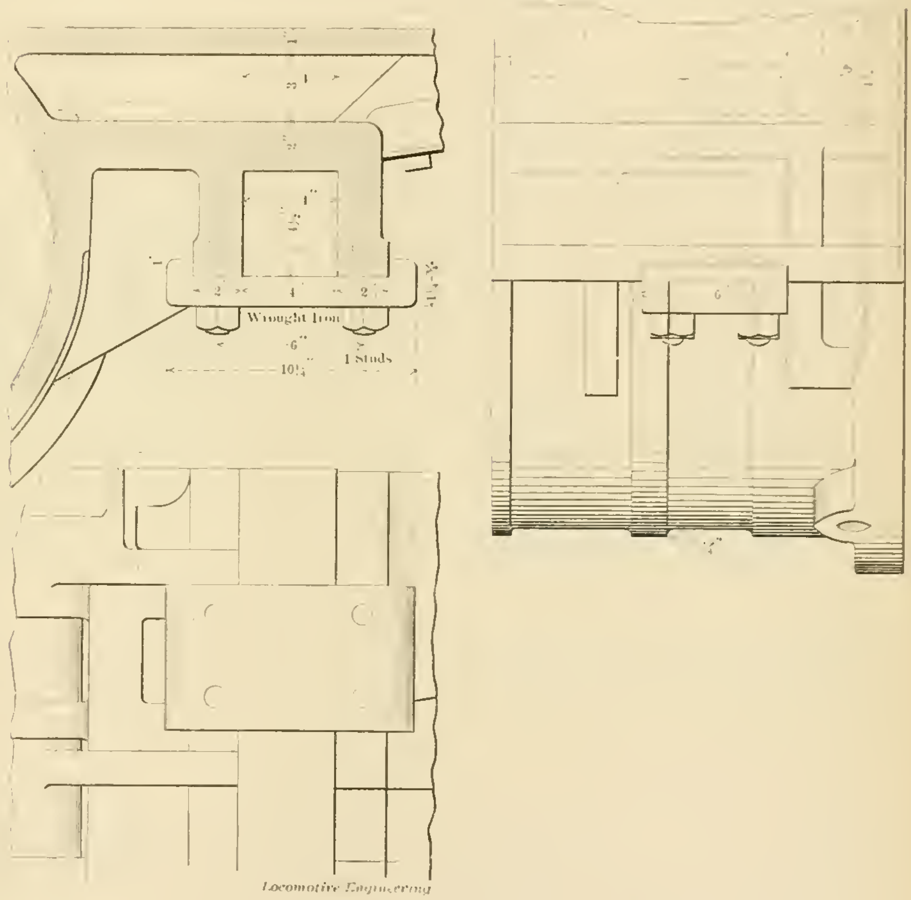
Express train speed appears to be getting common with the swifter class of torpedo boats. A boat of this character, tried last month in England, made a speed of 32 knots, or nearly 38 miles an hour.

Southern Pacific Cylinder Fastening.

A marked flavor of originality in design is evident in our illustration of the method of securing cylinders to frames on the Southern Pacific Railway. An examination of the engraving will show that the old and familiar scheme of bolting has been discarded. In fact, no bolts pass through the frame either vertically or horizontally, but the fastening is seen to consist of clamps and studs on the underside of the frame.

All tendency to horizontal movement is eliminated by the keys and lugs on the frame at the ends of cylinder in the usual way, and this is the only similarity between the old and new fastening. The cylinders are cast with a double flange at the frame fit, forming a recess the full depth of the frame section. The flanges finish 2 inches thick to receive the studs, of which there are four, 1 inch in diameter. requiring the handling of from six to eight driving fit bolts to accomplish the same purpose, as it has been found by long experience to answer every call made on it for holding a cylinder rigidly in position, and while the cost figures are not at hand, the clamp system looks to be the cheapest, for the reason that there are no holes to drill and ream through the cylinders and frames, nor any driving fits to make on bolts, all of which is in favor of the clamp when putting up new work. The same argument holds for removing a pair of cylinders, for it will be conceded an easier and cheaper operation to remove the nuts from the studs, even if splitting them off has to be resorted to, than to attempt to back out bolts with the sledge or cannon, and perhaps be obliged to drill them out at last.

We are assured by Mr. Small, superintendent of motive power, that this fasten-



SOUTHERN PACIFIC CYLINDER FASTENING.

The clamps are 1¼ inches thick, by 6 inches wide, and 8 inches long between the lugs, which are turned up ¾ inch at each end to span the flanges passing over the frame, the underside of which is flush with the clamps. The latter are placed at a distance of 4¾ inches from the ends of the cylinders, and the two constitute the fastening of each cylinder, vertically and laterally.

In the matter of applying or removing a cylinder, this method should be far better in point of convenience than the one

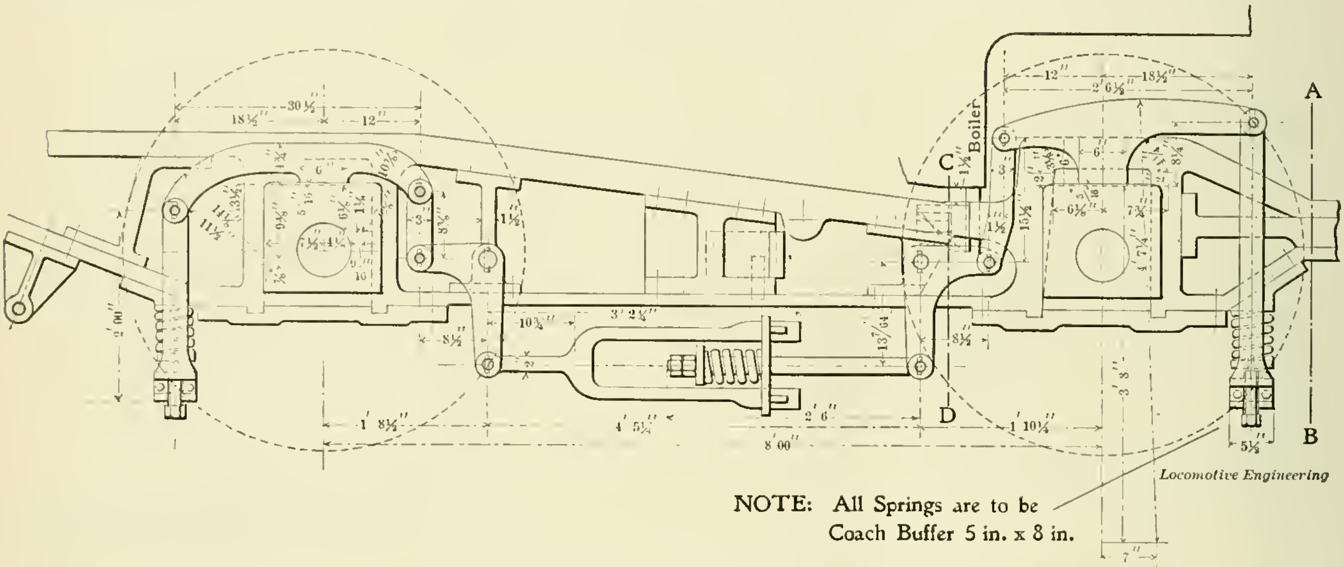
ing has been the practice for a number of years on his road, and has been found highly satisfactory. Notwithstanding the fact that the idea is not strictly new, it is not of general knowledge among locomotive men; it will therefore be of interest to many.

Our contention that this method is superior to the old one, appears to be sustained by the report that a prominent locomotive works is about to adopt it as a standard fastening for all cylinders not otherwise specified.

Underhung Springs—Long Island Railroad.

A spring rigging for underhung springs is shown herewith, which was devised and applied to one of his passenger engines by Mr. S. F. Prince, Jr., superintendent of motive power and equipment of the Long Island Railroad. This arrangement was designed to obviate the tipping of driving boxes and the consequent wear on wheel hubs, that was present in the old underhung rig with the bar equalizer and the hook hangers over the tops of the driving boxes.

It will be noted that there are no half-elliptic springs in this rig, all springs being of the coil variety, and one of these doing duty in the link between the bell cranks which connect with the equalizers resting on the tops of the boxes; the bell cranks and spring connection serving as a flexible equalizer between the wheels. Adjustment for tension is provided for at each spring. The record of this rig, after some months' trial, is said to be highly satisfactory.



UNDERHUNG SPRINGS.

Mineral Wool.

Nearly all railroad men are more or less familiar with mineral wool, which is used to some extent for packing beneath the floors of passenger cars and a variety of other purposes. It ought to be used a great deal more than what it is, especially for filling the hollow spaces of passenger cars, which are too often filled with shavings and other inflammable matter. The advantage of mineral wool for this purpose is that it will not burn; besides that, it is a deadener of noise and is a non-conductor of heat.

In a recent consular report we find the following description of how this wool is made:

"The wool appears on the market in a variety of colors, principally white, but often yellow or gray, and occasionally quite dark, and is made by converting scoriæ and certain rocks, while in a molten state, into a fibrous condition by a steam blast directed against the liquid material. Blast furnace slag forms the raw material for one variety of wool and sandstone for another, yielding respectively, slag wool and rock wool, the latter being preferable for pipe covering, because of the absence of sulphur, which with moisture present becomes an active corroding agent.

"The furnace slag or the rock, as the case may be, is melted in a large cupola, and as it trickles out at the tap hole in a somewhat sluggish stream it meets a high pressure steam jet which atomizes the woolen material, if it may be so termed, blowing it in fleecy clouds into the storage room provided for it. Soft and downy, the stuff settles wherever a resting place offers itself, the heavier wool coming down first, while the lighter portions are blown further along by the force of the steam and settle in the more distant parts of the room. The material thus naturally grades itself into varieties of different qualities.

"A thousand pounds of wool per hour are turned out by one of the cupolas, and after the storage room has been blown full, the flocculent mass is pushed into bags, ready for the market. The whole process affords an admirable and interesting illustration of the utilization of a formerly waste product."

The Allen Valve.

The Allen valve, with its double ports which greatly help to maintain unusual pressure of steam in high speed engines, has made fair progress in American locomotive practice, but there is still considerable prejudice against it. This prejudice, we believe, is founded in want of experience, or in a mistaken view of what the capabilities of the valve are. While this conflict of opinion continues to exist, we think that some remarks made by Mr. E. M. Herr, superintendent of motive power of the Northern Pacific Railway, at a meeting of the Western Railway Club, might be studied to advantage. The discussion was on lead in the setting of locomotive valves, and in this connection he said:

"With a very long port you can give an engine less lead than with a short port, and the kind of valve used has also an effect. With an Allen ported valve you can still further reduce the lead and get the same work out of the engine. The Allen valve, in my opinion, is a very valuable device if rightly used, and I believe that many railroad men condemn it because they have not used it in just the right manner. You do not get the full advantages of an Allen valve if you give it anything like as much lead as you would a plain valve. One of the principal advantages of an Allen valve is that you can reduce the lead and still retain the mean effective pressure in the cylinder. Of course, there is another advantage with the Allen valve, and that is the more rapid admission of steam into the cylinder, and this enables a locomotive at high speeds, with an Allen valve, to very much exceed in power the same engine with a plain valve.

In making some tests on the Northwestern testing plant not very long ago, we showed very conclusively that at high speeds a 16 x 24-inch engine would develop more power with an Allen valve than a 17 x 24-inch engine, with practically the same size of driver, would develop with a plain valve. In fact, a 16 x 24-inch engine on a certain division, where the ruling grade could be approached on a good run, was put in freight service with 17-inch engines, and it did satisfactory work with the 17-inch engines, pulling over rugged parts of our division, until one day the train happened to stop at the foot of this ruling grade. That day the engine stalled, and it stalled simply because it was not as strong as a 17 x 24 inch engine when pulling at slow speeds. At very high speeds it was stronger."

Locomotive Building in Russia.

The following interesting notes are culled from a private letter written by Mr. W. F. Dixon, chief engineer of the locomotive department of the Sormovo Company, Russia:

"Just now the place is pretty well littered up with all the builders' paraphernalia, as there are still a great many finishing touches to be put to the different shop buildings before they can be called ready. In the erecting shop we have got the floor down in the gallery, but the lower floor is still lying in piles outside the building. The boiler shop, wheel shop and foundry are all pretty well along, but there is still a good deal of machinery waiting to be put in place. Easter is rapidly approaching, and the laboring men are sneaking off one by one so as to get home to their villages by the time the holiday, the greatest of the year in Russia, begins. It is physically impossible to hold them, and the only thing to do is to make the best of a bad job and get along as best one can.

"We have got an order for twenty-eight freight locomotives of the Government standard type, two-cylinder compounds, and we are now working on the drawings and patterns.

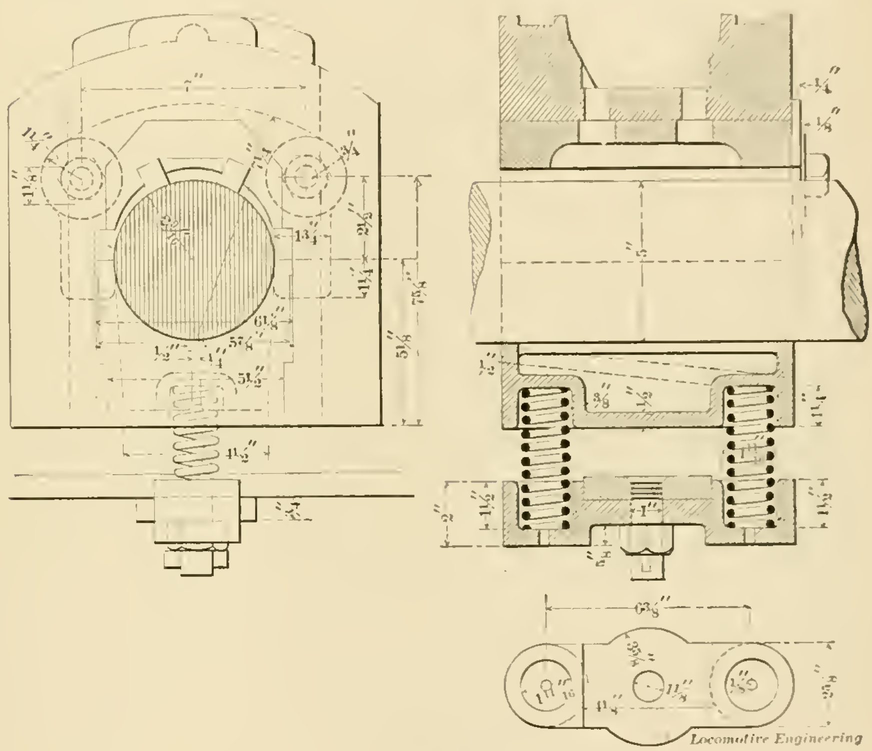
"We started up our bolt and nut department, in temporary quarters in the wheel shop, four or five weeks ago. All the bolt and nut machines are of the Pawtucket Manufacturing Company's make, and are proving most satisfactory. We are just getting the men onto piece work, and I find that a smart young man will turn out four times as many bolts as the best record they had round the place with the old-fashioned 'Olivers,' besides making more money than he ever has before in his life.

"Taking things at large, I am very well satisfied with the outlook, and, as far as business interests are concerned, do not regret, in the least, exiling myself."

Adjuster for Engine-Truck Cellar.

An arrangement for holding a truck-box cellar up to the journal, so as to make the former as nearly as possible an oil retainer and dust excluder, is shown herewith, as representing the practice of Superintendent of Motive Power Barnes, on the Wabash Railroad. Greater refinements in fitting than is usual with this class of work, aside from the adjusting features, are prominent points to catch the eye of the mechanic, as general practice has never sanctioned anything like contact between the journals and end walls of the cellar, for such fitting was believed to be harmful to the journal, or difficult to maintain.

As to the first count, not enough data have ever been collected to show that it was a tenable proposition; but as much cannot be said for the second, for it is notorious that a cellar supported on bolts is always going down and away from the journal, without any regard to the close work laid out on it originally. It was to prevent this action that brought about the development of the cellar shown, which is seen to be bored to a fit at the journal, and held to that point by means of two helical springs of 0.20-inch steel wire, 1½ inches in diameter. The springs are put in with just enough tension to overcome the weight of the cellar and wear, and are supported by a cast bar which is bolted to the tie strap of the truck frame; the bar and also the cellar are cored so as to form seats at either end of the springs.



ADJUSTER FOR ENGINE-TRUCK CELLAR.

The cellar side of the box is seen to be tight by this construction, and the brass is just as well taken care of by a ¼-inch brass plate which covers the gap left by the two-point journal bearing; this plate is secured to the box by two ¾-inch studs, and fits the journal, extending down at the sides so as to cover the top of the cellar, and thus make a continuous fit around the journal on the inner or exposed side of the box. The outside surface being in contact with the wheel hub, is not provided with any plate. There is in the cellar a rib at the center, which reaches up to the journal and divides the packing space into two equal parts, parallel with the journal, with the object of preventing the bunching of the waste. It may be argued that this construction is expensive; but when put in the balance against hot boxes and prematurely worn-out journals, it may be found the cheapest when followed up closely. It is the exception to find too much good work laid out on an engine truck, according to the light of our experience.

Fatal Accidents.

A man employed in one of the railway offices in Washington has for years been collecting newspaper accounts of railway accidents of all kinds. He now has thousands of these narratives and from an attentive study of them he has come to the conclusion that no locomotive engineer ever came alive out of his third disaster. This is all nonsense, of course, but there may be a basis of truth in the calculations.

It seems that this belief is widely held by engineers themselves, and the maker of the scrapbook asserts that it is so well supported by experience as to be almost as demonstrable as the law of gravitation or any other natural regulation. He does not insist that engineers are never killed in their first or second accident, but he does maintain with great seriousness that the man who has had two "close calls," will, if he is wise, abandon railroading and make his living some other way. It is not difficult to see how such a superstition should have arisen, for the chances that an engineer will three times survive the perils of collisions and derailments, greater for him than for anyone else on a train, are manifestly close to the vanishing point. To suppose that his danger is greater in the third than in the first wreck is, of course, merely another form of the delusion that "luck is bound to change."

Practical Letters from Practical Men.

Pneumatic Flue Roller.

Editors:

I inclose you herewith a sketch of a pneumatic device for rolling flues which is being successfully used in the West Springfield shops of the B. & A. R.R.

You will see that it is very simple and cheap in design, its principal parts consisting of the Phoenix pneumatic drill, marked No. 2, connected through a train of gears (shown on Fig. 2) and a flexible shaft (No. 6) to a Dudgeon flue expander (No. 1), the pin of which is provided with a collar, as shown, which is used to strike against in forcing in the pin. The shaft is connected to the gear marked No. 1 and the motor to No. 3, the intermediate one being used to obtain the right direction in the rotary movement of the shaft. The brace (No. 3) is used to prevent the motor revolving.

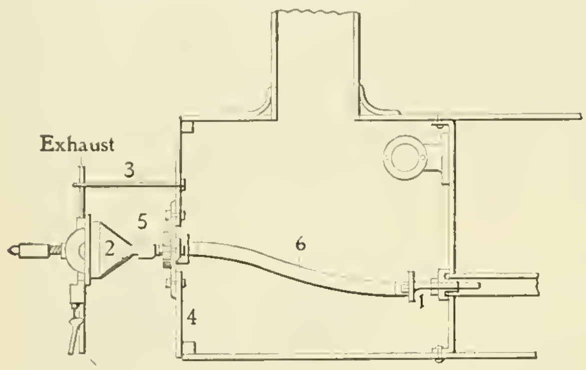


Fig. 1

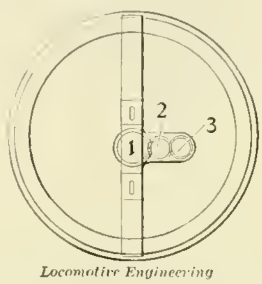


Fig. 2

PNEUMATIC DEVICE FOR ROLLING FLUES.

You will also notice that the frame proper is made in three pieces, the center one being slotted on each end, and the other being secured to it by bolts which pass through these slots, thus becoming adjustable to any size of front end to which it is attached. In using this device in the firebox it is attached in a similar manner to the door opening.

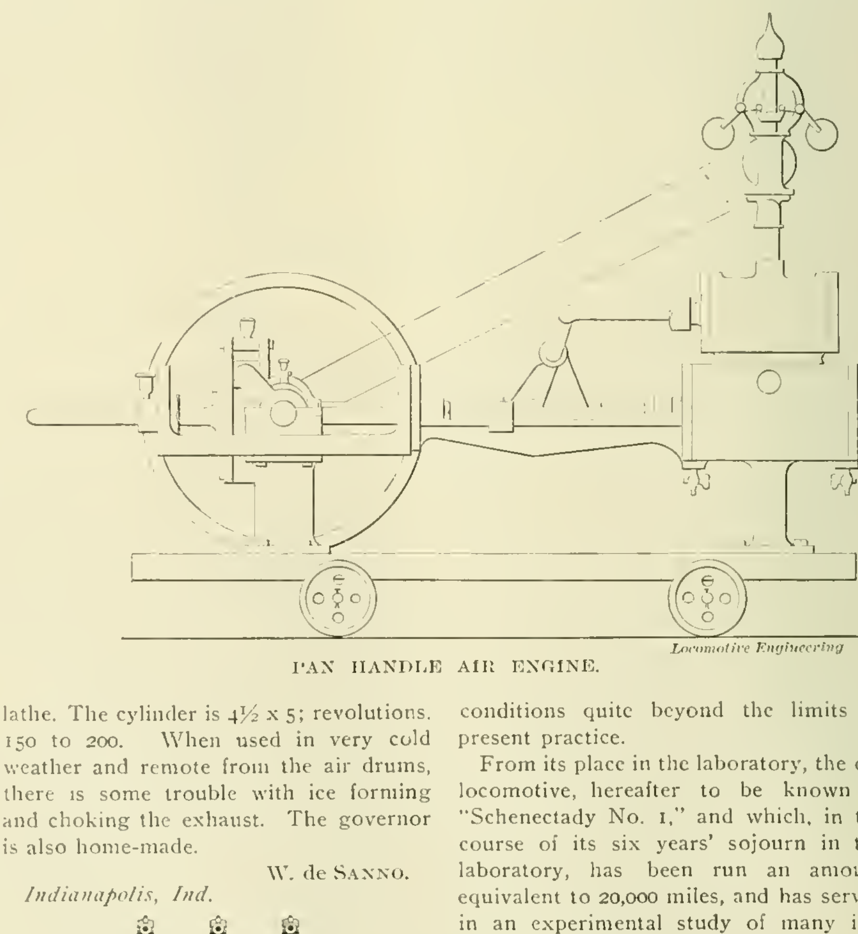
A practical test shows that this machine has a capacity of thirty-four flues an hour.

B. J. Graham,
General Foreman, B. & A. R.R.
Springfield, Mass.

Another Air Engine.

Editors:

Inclosed please find sketch of a handy little air engine for general shop purposes, and made out of an old steam pump by Mr. E. Carr, machine foreman in the Pan Handle shop at this place. It goes to show that scrap-iron can be put to a good use when handled by a man of brains. You will notice the water cylinder is removed, and an extension made out of a slide-valve casting is bolted on in its place, to carry the crank shaft. A new piston valve was put in, operated by an eccentric, as the kick motion incident to a pump was likely to run the engine either way. The engine is arranged for either belt or rope drive, and will run any machine in the shop, except the frame planer, or wheel lathe. The cylinder is 4½ x 5; revolutions, 150 to 200. When used in very cold weather and remote from the air drums, there is some trouble with ice forming and choking the exhaust. The governor is also home-made.



PAN HANDLE AIR ENGINE.

W. de Sanno.
Indianapolis, Ind.

New Locomotive for Purdue University.

Editors:

Believing that you will be interested in anything which contributes to the advancement of railroad work at Purdue, I take pleasure in sending you a few lines with reference to a matter which, as it seems to me, marks a new point of departure in the progress of engineering research.

Purdue University has to-day closed a contract with the Schenectady Locomotive Works for a new locomotive to be used in its engineering laboratory, in connection with courses in railway engineering.

The new locomotive will possess a number of features which are quite new. It will carry a steam pressure of 250 pounds, and will have cylinders so arranged that it may be used as a simple or a compound. The cylinders and the saddle will be made up of different castings, and the centers will be so chosen as to allow the use of cylinders up to 30 inches in diameter. Several cylinders will be provided, and these, with a suitable series of bushings, will allow for different cylinder ratios in compound work. The whole machine will thus afford facilities for dealing with conditions quite beyond the limits of present practice.

From its place in the laboratory, the old locomotive, hereafter to be known as "Schenectady No. 1," and which, in the course of its six years' sojourn in the laboratory, has been run an amount equivalent to 20,000 miles, and has served in an experimental study of many important problems connected with locomotive design, will pass into active service at the head of trains on the road, while the new engine, "Schenectady No. 2," will take its place upon the testing plant.

By the terms of the contract, the present engine, "Schenectady No. 1," will be delivered to the Schenectady Locomotive Works within the present month, and the new engine, "Schenectady No. 2," will be delivered early in the fall.

A large amount of data derived from "Schenectady No. 1" during the past year will soon be issued from the laboratory, and as soon as practicable all of the papers descriptive of work accomplished in connection with this engine will be published in a single volume.

Wm. F. M. Goss,
Purdue University.

La Fayette, Ind.

Air-Pump Exhaust.

Editors:

I noticed an article in the May issue of "Locomotive Engineering" about the wasting of fuel by air-pump exhaust fanning the fire. I herewith send you a blueprint of a device that I have applied to a great many engines. It is simple and cheaply applied by using vertical valve cylinder cocks attached to cylinder cock rigging, same applied to opposite exhaust port, and used for bleeding exhaust ports when engine is standing, and allows the air pump to exhaust into the atmosphere when cylinder cocks are open and when shut they exhaust through the nozzle tips without affecting the fire to any great extent. I find it a great fuel-saving device, particularly where 9½-inch pumps are used.

F. T. Hyndman,
Master Mechanic.

Allegheny, Pa.

Boiler Washing Nozzle.

Editors:

Anyone who has had anything to do with the washing-out or care of locomotive boilers realizes the importance of keeping the lower part of the shell clear of sediment; for when this is filled up with deposit, the space between the flues fills up in a very short time.

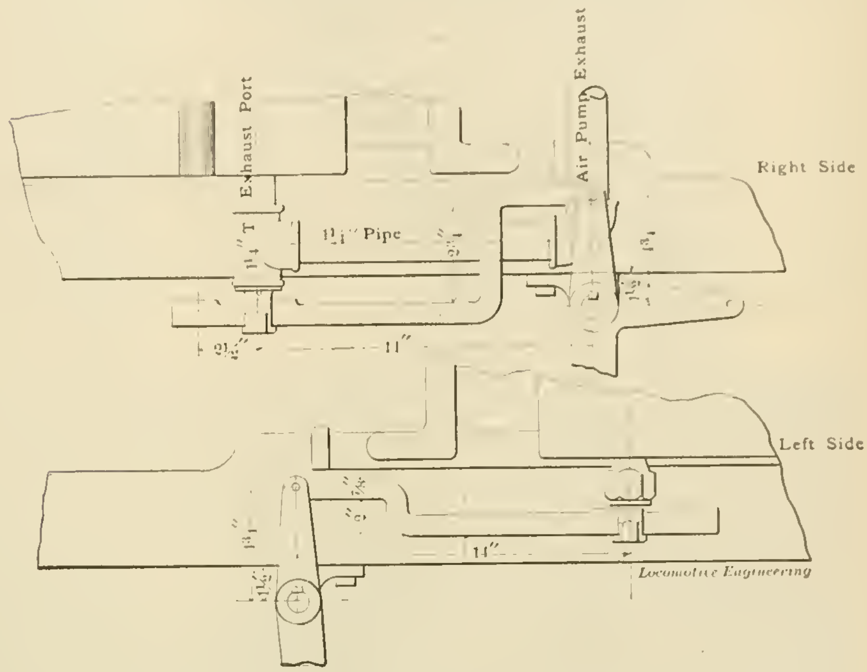
The old way of inserting a bent nozzle into the shell from the pit, and then getting out and turning on the water and seeing the pressure turn the nozzle in some other direction from that in which it was intended to throw the water, was found to be not only conducive to profanity, but also to indifference. As a natural consequence bad results followed; for even when the nozzle was held in position with pipe tongs, it made the matter no better, for as soon as the grip was loosened the nozzle would be turned by the pressure and was always liable to fly out of the hole.

To overcome these difficulties and get better results, the nozzle shown in cut was made, and twelve of them have been in use for over three years on the Burlington, Cedar Rapids & Northern Railway, with very good results. The nozzle is made of 1-inch pipe, this size giving the best results for all pressures. Coupling *C* is a common pipe coupling, and is loose at the lower end, so that the elbow may be turned in any direction. The rod by which the elbow is turned is made of ½-inch iron, the jaw being deep enough to clear the flattened end of the clamp on coupling *C* when elbow is being turned. The handle on the end of nozzle is for the purpose of holding the nozzle in position as well as changing its position.

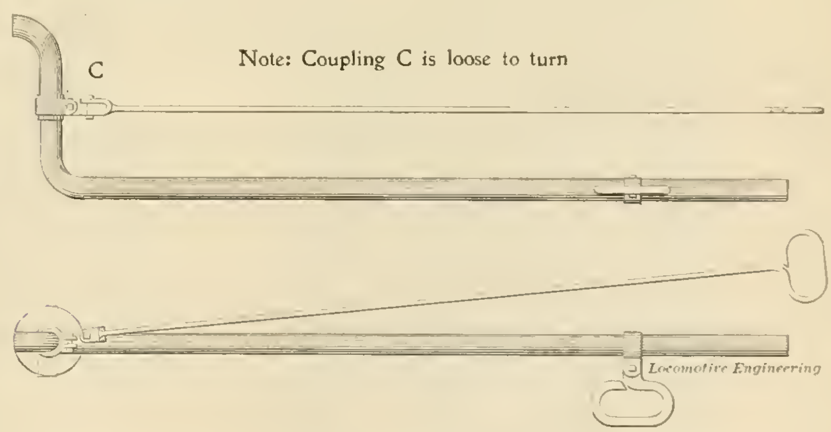
The nozzle can be held in any position, and can be inserted through spokes of drivers or any other close place about a locomotive, the operator standing on the floor and running no risk of being wet to the skin, as he did by the old way. To use the nozzle successfully two or three holes are necessary in bottom of shell; 1¾-inch is large enough.

Henry J. Raps,
Foreman Boiler Maker, B., C. R. & N. Shops.

Cedar Rapids, Ia.



AIR-PUMP EXHAUST AND PORT COCK FOR PASS. ENGINES.



BOILER WASHING NOZZLE.

Objecting to Improvements.

Editors:

Recently, in conversation with a railway official, he expressed himself as being entirely hostile to the M. C. B. automatic coupler. Said he: "It is expensive both to apply and maintain. It is too complicated to stand the rough usage to which couplers are necessarily subjected; causes serious delay in switching when it is out of order, and is condemned by trainmen; and the railway companies are looking to their mechanical departments to produce something which will overcome these deficiencies."

I inquired if he had kept any record of cost of maintenance of either link-and-pin or automatic couplers. He replied that he had not, and did not know if any other road had done so, but he thought he was expressing the general opinion.

I believe the present cost of links and pins alone will maintain M. C. B. couplers after all cars are equipped with them, and probably 90 per cent. of breakage of M. C. B. couplers is now due to the link-and-pin couplers. I estimate at least one link and two pins per month will be lost, broken, or stolen from each car: 12 links and 24 pins = 240 pounds wrought iron @ 1⅝c. = $3.90 total cost per car each year. Our scrap piles are largely made up of broken link-and-pin couplers, but which we have grown so accustomed to that we do not notice the waste. The damage to draft rigging caused by slack of the link must be enormous, but can scarcely be estimated. There are many serious delays caused by link-and-pin couplers, when pins are bent in head of coupler, and are removed only by vigorous pounding with the fireman's coal pick and much profanity. Also, when switching at night with twenty to forty cars, pins frequently jump out and cannot be found, causing a long trip to engine or caboose for another. At coal mines and sawmills, after a snowstorm, many pins are on the ground, buried under the snow, and remain there until the Spring thaw.

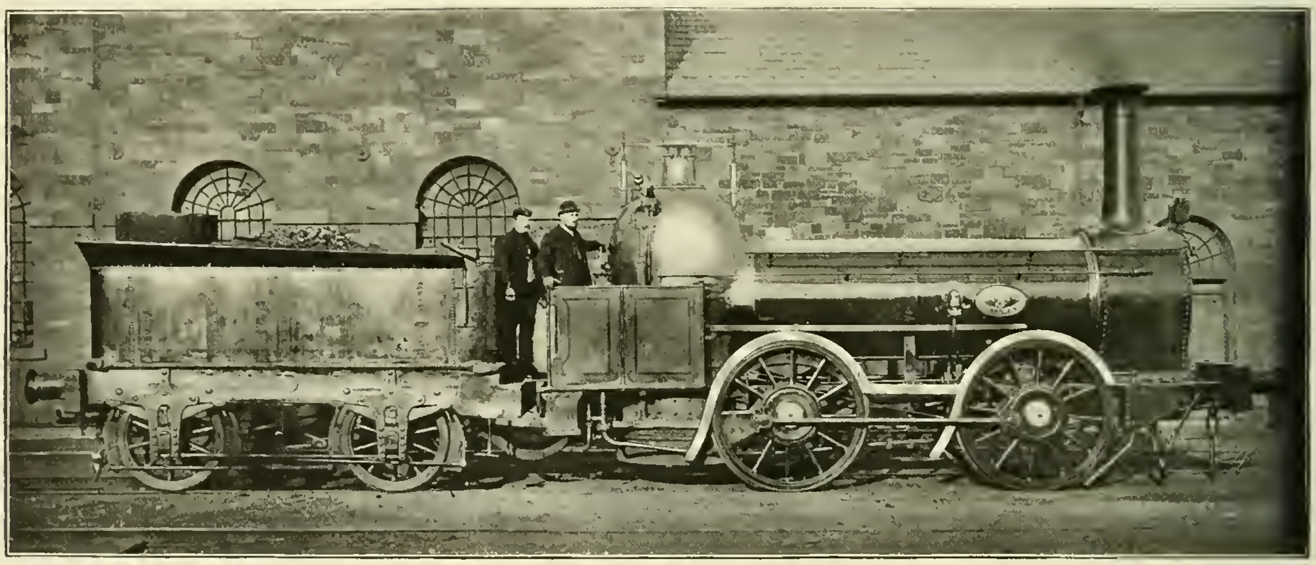
I overheard a switchman loudly condemning the M. C. B. coupler, and emphasizing his remarks with gestures of a hand which had only a thumb and one finger, the remainder having been sacrificed to his favorite link-and-pin coupler. An old and very successful conductor, condemning the standard train rules, said: "The old rules were so complicated that it required a long experience to successfully work under them, while any schoolboy could soon master the standard rules, and conductors are getting too plentiful."

This is a mistaken idea, for, with the advent of the modern safety appliances, the standard of qualifications has been raised by railway companies, and they require a more intelligent but less reckless class of employés.

I remember that a convention of railway officials several years since decided the air brake was not adapted to freight service on acount of being too expensive to apply and maintain, and delays were too great in coupling and uncoupling hose when switching; that the successful freight brake must have no other connection than the drawbars between the cars. The American freight buffer brake soon appeared and was quite extensively applied by several roads. It was probably cheaply applied, but not so to maintain, as it had more parts than a Waterbury watch, and such a rattling and banging as the pieces made when the train was running was never before heard. Windy Jones, the engineer, said: "It had one advantage, as it was not necessary to whistle for road crossings, for everybody in the township knew the train was coming, and some of the inhabitants went into their cellars to avoid the tornado which they thought was approaching." No official is now so foolish as to condemn the air brake for freight trains. Surely the world does move. Most of the opposition to the M. C. B. coupler is of the same class which has opposed every improvement since the days of George Stephenson. I hope ere long the only link-and-pin couplers extant will be found in museums, along with other barbaric death-dealing instruments, or on the pedestals with the "Puffing Billy" or the "Rocket." Meanwhile, my friend, the railway official is watching the Patent Office for the cheap automatic coupler, which, like the "one-hoss shay," cannot break down and will not wear out.

C. H. SMITH.

Birmingham, Ala.



OLD BURY LOCOMOTIVE.

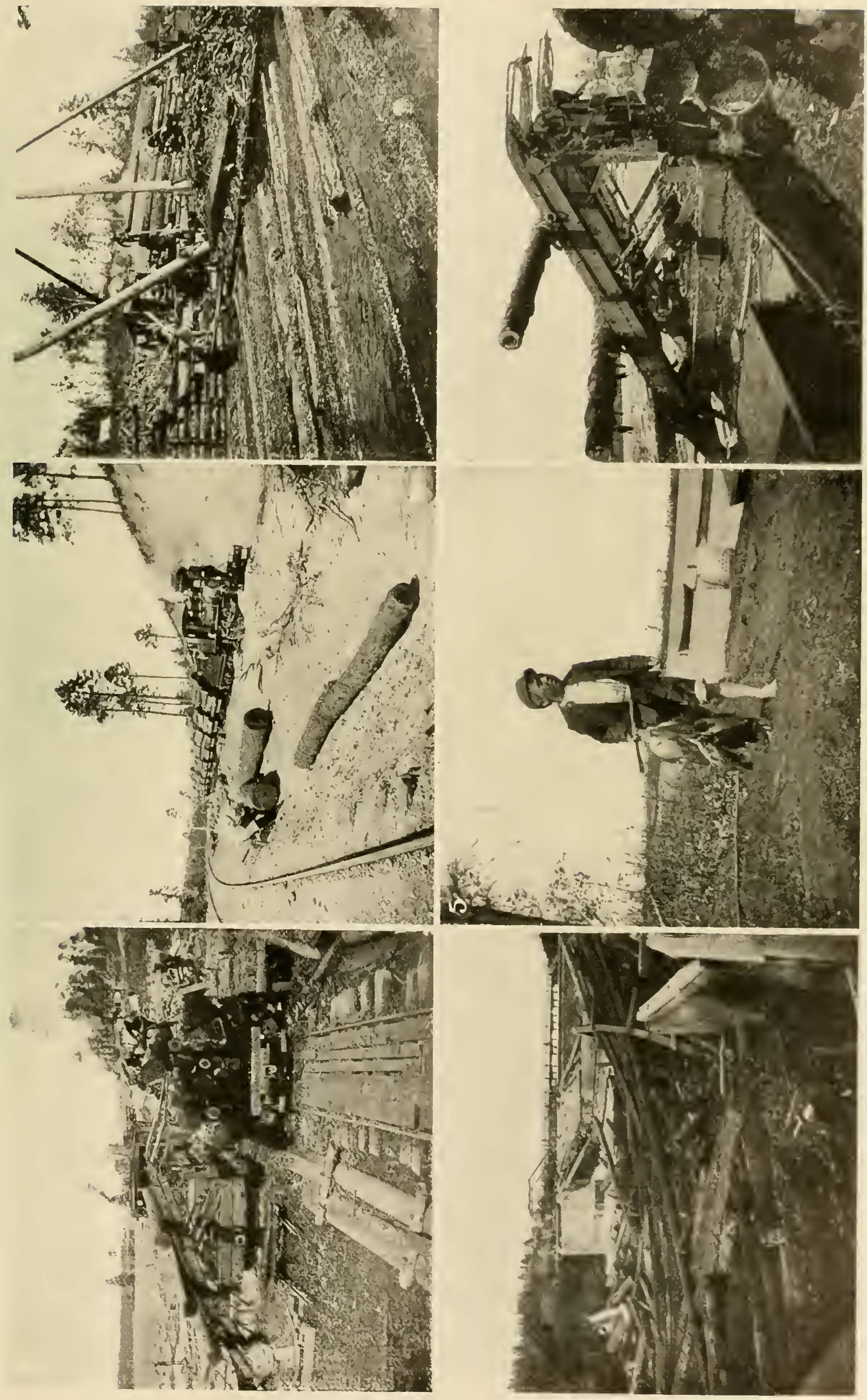
Old Bury Locomotive.

Editors:

I am sending you, along with this note, a number of photos representing Engine No. 3 of the Furness Railway Company, England. I believe her to be the oldest engine running to-day. In November, 1895, you produced in your paper a photo of No. 9 of the same railroad. No. 3 is much older, and you may compare data you have of her, with the following I shall give of No. 3: Engine No. 3 was built by Bury, Curtis & Kennedy, in Liverpool, England, about the year 1844, and was transhipped to Barrow-in-Furness, by boat, before rail communication was opened up. She has seen fifty years of service, first running regularly on main line, and recently on ballast train and switching purposes. She has driving wheels 4 feet eight inches; cylinders, 14 and 24 inches; weight of engine, 19 tons; tender, loaded, 13 tons. Improvements have taken place from time to time for the convenience of men as well as other and more substantial reasons, but the design or model is the same as when she first turned a wheel. Your reproduction of this engine will touch a chord in many an old-timer's heart, and though she may not be the idol of any, its dissemination as a photo may recall reminiscences and link hearts together wherever F. R. Co. "boys" are scattered.

The small photos and sketches I am sending may be produced or otherwise at your pleasure. They are the work of amateurs, all representing Engine No. 3. The one, with crew, well clad in overcoat, the indispensable winter adjunct for engines of this class, is here shown. Engineer Battersby is here shown with mate, who has had this engine some years. On the large photo it might be worthy of note, Engineer L. Longcake is in charge. He lost both feet in 1874, but still manages, by artificial feet, to occasionally mount the foot-plate. He is here seen near erecting shop, at some period when the engine has undergone repairs. Should you wish to produce this in condensed form in "Locomotive Engineering," you are at liberty to do so. Your paper, I think, gains yearly in popularity, and when an old, familiar-looking piece of scrap

(Continued on page 434.)



SNAP SHOTS ON A LOGGING RAILROAD.

(*Continued from page 432.*)

like the old "3" turns up occasionally, the "boys" think all the better of you, whatever road they were formerly on. I may, as time elapses, get the amateurs to take something of more modern construction on the Furness line, but for the present I must conclude my remarks.

JOHN NELSON.

Gleichen, Alberta, N. W. T.

[We regret to find that only one of the four photos sent by the correspondent is fit for reproduction.—Ed.]

A Great Logging Railroad.

Editors:

The cutting of all timber in the immediate neighborhood of rivers and streams available for driving, and the demand for facilities for getting the interior logs to market, was the necessity which called lumbering railroads into existence. They have almost revolutionized the lumber industry. Before their advent only as many trees were felled as could be taken care of while the snow lasted; now as many are cut as can be hauled all the year around. Then the logs went to the thoroughfare over long roads on immense sleds; now the thoroughfare goes to the logs. Much depends on the elements—plenty of snow for the roads in winter, and the right stage of water to drive them in the summer. Now, provided it gets cold enough to freeze the swamps (little doubt but what it will in Northern Minnesota), we are almost independent of the weather. As it sometimes requires two or three years for the logs to be towed across lakes and floated hundreds of miles down the circuitous streams, a large amount of capital was idle; while now, timber cut one winter can be delivered at the mills and made into lumber the same season.

The main line of the Brainerd & Northern Minnesota extends from Brainerd on the Mississippi River to the western end of Leech Lake, at present. From various points main branches extend into the timber districts, and from these in the fall, lines are run to various loading places. These logging spurs require little grading, the ties being thrown on the surface of the ground and shimmed up at the ends so as to support the rails; sometimes across "muskeg" swamps, which are only safe when frozen solid; the same rails and ties being frequently used on two or three spurs the same winter. Many places where it would be dangerous to run an ordinary locomotive, we use Shay patent side-geared engines, which can "turn a right angle and climb a tree."

Contrary to the popular impression, the trees are not chopped down, but "undercut" or notched with an axe on the side in which direction it is desired the tree should fall, and then sawed off from the opposite side by "timber jacks" working a two-handled cross-cut saw. When on the ground, the tree is trimmed, sawed into lengths of from 12 to 18 feet or more, then hauled and skidded alongside the track. In loading the cars from the skidways, a team of horses, by means of a chain, roll the logs into position; the load being firmly secured in place by two chains in the middle and corner-bind hooks on the ends.

The lighter locomotives having delivered the loaded cars on the main branches, heavier ones pull them to the main line, where they are made into trains of thirty-five to forty cars and hauled to Brainerd. A winter landing or rollway containing 30,000,000 feet of logs, with train partly unloaded, is shown in photograph.

As it is not practicable to cut and haul logs to the track in summer, part of those cut in winter are hauled onto inland lakes, boomed up in the spring, and, when the ice goes out, are loaded with gin-pole hoisters or loading machines, as shown. Each kind works in pairs, so two cars are loaded at a time at each loading works. Under favorable conditions, i. e., fairly large logs and wind holding them close to shore, 150 to 175 cars may be loaded per day by one pair of machines. Something of the hazardous work of loading may be imagined by noting in the picture the man caught in the act of stepping over a log. As the log comes off the skids, the men on the load stand with one foot raised for that much of a start for a jump in case it rolls too far. While the B. & N. M. is primarily a logging road, and hauls more timber in a season than any other, I am told (150,000,000 feet in 1896), it does a good local freight and passenger traffic incidental to the settling up of the country, and is developing a great summer-resort business. Leech Lake, with its 700 miles of shore line, is the largest, and by some claimed to be the handsomest body of water adjacent to our line; but where you can, at one point in our territory, find 175 lakes within a radius of fifteen miles, and each one picturesque, it is hard to yield the palm to any one of them. All the lakes abound with fish, and many have never had a hook cast in their waters. The picture showing what a boy can do in a quarter of an hour before breakfast makes it unnecessary for me to tell any fish stories.

J. N. SANBORN,
Master Mechanic.

Brainerd, Minn.

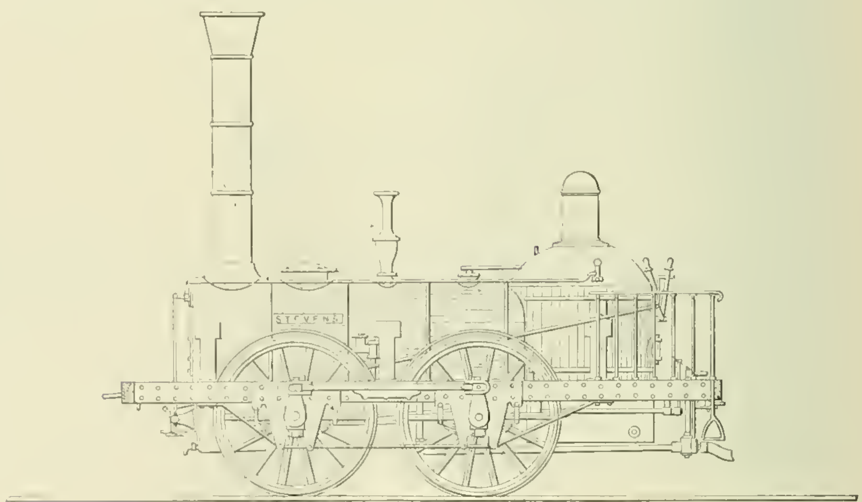
The Locomotive "John Bull."

Editors:

Many photographs and diagrams exist of the engine "John Bull" now at Washington, but no complete official elevation of the engine as it was when it left the works of R. Stephenson & Co. has yet appeared in print in this country. I therefore think the diagram sent herewith will be of interest on both sides of the Atlantic.

CLEMENT S. STRETTON, C. E.

Leicester, England.



ORIGINAL DRAWING OF THE JOHN BULL.

Some Facts and Fancies Concerning High-Speed Engines.

Editors:

Is it possible to balance a reciprocating weight by the use of a revolving weight when coupled together as in a horizontal steam engine? In other words, can the horizontal disturbing forces of the reciprocating parts be transposed into an equal vertical disturbing force by the use of a counterweight in the crank, as is commonly admitted? Several writers, in discussing this question in some of the recent engineering journals, have advocated the use of heavy reciprocating parts, on the ground that the pressure on the crank pin can be so adjusted by this means, in simple expansion, high-speed engines, as to remove or neutralize the troublesome horizontal vibration. What possible relation the pressure on the crank pin, whether it is equal or unequal throughout the stroke, can have to these unbalanced forces, on any other questions than those of the regulation of the speed and the prevention of "pounding," is not explained. Vibration and pounding are the bane of the high-speed engine, but these writers seem to confound the causes of these entirely distinct effects. The conditions which produce the latter effect can undoubtedly be altered by an increase in the weight of the piston and its connections, but that it would be a change for the better is not so apparent. The shock produced by the sudden application of power to the crank pin, after the centers are passed, would of course be modified, but at the same time the difficulty of reversing the pressure on the crank pin before the centers are passed would be increased in exact ratio to their increased inertia. If this pressure is reversed in time, the sudden application of power to the crank pin after the centers are passed could not produce pounding, and therefore any reduction of this pressure that might be effected by an increase of the weight of these parts would be of no importance. If it is not reversed in time, the additional weight of the parts, although it would modify, would not eliminate this effect.

The relation of clearance to compression is an important factor in the proper adjustment of these conditions, and also in the economy of the engine. With small clearance, a late beginning of the compression will establish the same pressure at the end of the stroke as would be obtained with large clearance and an earlier compression. In the former case the pressure increases very rapidly during the last inch of the piston travel, as the cubical contents of the space before the piston is much more rapidly reduced, and thus the compression is accomplished near the end of the stroke, where it is needed, and where, owing to the position of the crank and the low piston speed, it is obtained with the least expenditure of energy. It is therefore evident that compression equal or nearly equal to boiler pressure can be obtained under these conditions, with a considerable reduction in the energy required, and with the timely reversal of the pressure on the crank pin assured. The real explanation of the economy shown by certain engines conspicuous for small clearance is undoubtedly attributable chiefly to this cause. The less the volume of steam compressed, the better for the economy of the engine, as experience has shown that it can be manufactured much more cheaply in the boiler than the cylinder.

One of the writers mentioned, who is a recognized authority in engineering circles, in discussing the subject of clearance losses, apparently overlooks the importance of this relation, and entirely misunderstands the relation of clearance to expansion. He says that seven per cent. clearance, with one-sixteenth cut-off, would be ruinous to the economy of an engine. After the steam is cut off from the boiler, the effective pressure is then entirely dependent, for the rest of the stroke, on the volume admitted, and whether it is contained in the clearance or cylinder spaces, it is all equally valuable in maintaining the expansion line. The contents of the clearance spaces add nothing to the effective pressure during the admission periods, but as very little work is done in the cylinder for the first sixteenth of the stroke, the loss in this instance would be very trifling indeed. The entire admission space, for the first sixteenth of the stroke, is almost equivalent to so much actual clearance, because the steam presure is almost non-effective, owing to the low piston speed and the position of the crank. When steam is worked without expansion, a total loss of the clearance contents is sustained, because the effective pressure is not increased an atom thereby, and therefore it follows that the greater the expansion the less the loss from clearance. The writer in question evidently mistakes the large ratio of initial loss for actual waste of steam, and also overlooks the fact that the relation between large clearance and expansion is a very different thing from that between large clearance and compression.

When an engine is running by its own momentum, after steam is shut off, the inertia of the reciprocating parts acts as a pulling disturbing force, which, unless counterbalanced, is applied to the main bearing, through its connection with the crank, and produces or tends to produce horizontal vibration. When the engine is loaded, the static inertia of these parts is transferred as a pushing disturbing force to the cylinder heads, because the steam pressure against the cylinder heads is unbalanced to the exact extent of this inertia, unless it is neutralized by the centrifugal action of the counterweight. For the same reason the disturbing force induced by the dynamic inertia of these parts is also transferred, or partially transferred, by compression, to the cylinder heads. Thus the situation is not affected, either for better or worse, in so far as these forces are concerned, by the action of the steam.

As the counterweight advances beyond the centers, its effective balancing power is removed, by the change in the direction of its action, to that of the steam pressure against the cylinder heads, although, as it approaches the centers, its position improves in this respect; but the dynamic inertia of the piston and its connections is then being gradually expanded, while its centrifugal action remains constant. The counterweight would thus be almost wholly unbalanced during the last inch of the piston travel, which, with a 12-inch stroke, is nearly equal to one-ninth of its revolution. Thus it appears that there are only two short sections of its revolution when an excessively heavy counterweight can be approximately balanced, viz., during the first quarters, and also at points near the three-quarter strokes.

Taking these facts into consideration, it is difficult to discover where any improvement, by the use of heavy reciprocating parts, can be derived. On the contrary, the disturbing forces induced by the inertia of these parts, and the difficulties of the man who undertakes to balance them by the use of a revolving weight, will be proportionately increased.

W. F. CLEVELAND.

Moncton, N. B.

Duluth & Iron Range Shops.

Editors:

Many of the different shops over the country have been written up within the past two years, ground plans shown, special machinery and kinks elaborately illustrated, while the neatest and most complete little shop in the whole northwest remains in obscurity, possibly on account of its geographical location, which throws it out of the well-beaten path of correspondents of mechanical papers; but if they would seek for hidden treasures and unexplored territory, they should visit this little town on the north shore of Lake Superior.

Although we are, in miles, a comparatively small road, we are the biggest little road in the United States, and a very important factor in one of the greatest industries of the world, viz., the mining, transporting and manufacturing of iron ore.

This company owns its mines, railroad from mines to lake shore, docks capable of holding 75,000 tons of ore, and facilities for loading a boat with 2,500 tons of the same in less than two hours, its tugs and steamers to carry the ore to eastern markets, and is also interested in some of the principal manufacturing plants of steel and iron work.

We have a 52-stall roundhouse of brick, steam heated and electric lighted, transfer table of steel, and operated by cable from line shaft, leading to the erecting shop. The erecting shop is 90 x 240 feet, with facilities for overhauling ten engines at a time. A drop pit operated from line shaft, capable of taking out four pairs of drivers in forty minutes. This shop is built from the latest and most complete designs; the structural work is all of steel, the peak of roof being 40 feet from floor; double row of sky-lights with glass run over wire netting for safety in case of breaking from any cause; heated by steam and lighted by electricity; supplied with every convenience and latest appliances for doing work; and it is the universal opinion of all employés and visitors that we keep our motive power and rolling stock in the best condition of any road in the country. This is the only road of which the writer has any knowledge where every engine and car on the system is equipped with air and automatic couplers with solid knuckles, so that links and pins are unknown.

The officers of the road take great pride in the machinery department, the reason being that they were reared in that department. Our president and general manager, Mr. J. L. Greatsinger, was at one time master mechanic, then superintendent, then he was elevated to his present position. Our present superintendent, Mr. Thos. Owens, was an engineer in days gone by, and our present master mechanic, Mr. H. S. Bryan, is one of the old-time master mechanics, and well known by all railroad men. He is not one of the old fogies that believe in keeping back the tide of progress, but is up to date, having no hobby, unless it should be the "Bryan draw-bar attachment," of which he is the inventor and patentee, and may justly be proud of the record it has made.

Air seems to be one of the favorite topics of the different writers at present, the Covington plant being the latest. They are all nice, being useful as well as instructive; but ours is a little more complete and just a little nicer (begging pardon for the egotism). You will notice by the photographs taken by our shop photographers, Messrs. Miller & Morrison, that we have represented an engine and car with two 8-inch Westinghouse air pumps, one of them bushed to 6 inch for pumping a higher pressure when needed. Our gages show every pressure in the different pipes. The governors, lubricators and gages are all nickel-plated (this we do ourselves).

In the center of the line of gages is an index gage showing what the different colors represent—black being steam; green, main reservoir; blue, train line; red, signal line; brown, brake-cylinder pressure. The pipes, engineer's valve and cylinders are all painted and varnished according to index. You will notice we have the cut engineer's valve connected to working valve (E-6 model), the cut quick action triple connected by piston to working triple, emergency part being worked by a system of compound levers similar to the one recently illustrated, only we do not disconnect the quick-action part. We use the cut retainer in actual service so it can be seen and it works just the same. We have the conductor's whistle valve and brake valve on end of pipes with cords running over line of gages. Our main reservoir is in a pit under floor, also lye tub for cleaning pumps. It has a steam tight cover with a condenser attached. Over this is a 6-inch air lift, which swings with a 14-foot radius. The second picture is to show our operating table. This is the main feature of our air department, and, we think, entirely original. The cylinder and piston are of cast-iron, cylinder bored 3 inches, piston 18 inches long, 8 inches of the cylinder being below the floor line. The base is fastened to floor with lag screws; the right-hand pipe (¼-inch gas-pipe) leads from reservoir through *T*, pet cock and left-hand pipe to bottom of cylinder, which has a 1-32 port. Connected to the *T* of left-hand pipe is another ¼-inch pet-cock for releasing, and a ⅛-inch hole drilled through cylinder 4 inches from top as a safety port. The top is of 3-16-inch boiler iron, flanged for strength, riveted to a cross-piece of 1½-inch square iron with lock nuts on either end to fasten table at any angle, and swings from perpendicular to horizontal on either side of piston. The piston may be turned around in cylinder at pleasure, and a set screw locks it in any position. To put on a pump we let the table down, turn the table to perpendicular position, stand the pump on air end and bolt on. With one hand the pump may then be lifted to the horizontal position, then turned or raised to any position. The oblong holes are cut out to admit of wrench to take out center or either cylinder of pump.

We have other improvements in contemplation for our air plant which we may illustrate at some future time.

D. P. Kellogg,
Ass't Gen. F'man Loco. Rep

Two Harbors, Minn.

Tools on Locomotives.

Editors:

I see in last month's "Locomotive Engineering" someone thinks we ought to have jacks and more tools on engines. We have engines here that have not had any jacks or chains on them for over four years, and I don't see but what we get along just as well as we did when we carried them. It is one time in a hundred that you can use a jack after it has been carried six months or a year. As they are put in a box on back end of tender, the tank is run over, the water gets into box, and jacks rust so they cannot be used. My idea is to carry jacks in the baggage car and saloon car; then, when wanted, they could be used.

He thinks we ought to have more wrenches. Suppose we carried a wrench for every sized nut, where could we put our coal on some of our old engines? All the tools I think necessary on an engine are two monkey wrenches, one 15-inch and 18-inch; one hard hammer; no soft hammer, as I never saw engineer use one when he breaks down and is in a hurry; two cold chisels; one set chisel; four oil cans—one oiling round, one valve, one engine and one 2-quart can; fireman's shovel, bar hook and hoe; two tapering oak blocks to raise engine—all to be numbered the same as engine, and not to be taken off, only when engine went into shop. I had an engine come into shop for tires, and this is what they took out of tender boxes: Seven air hose; four steam hose; eight tender brasses; three head truck brasses; four jacks, two large, two small; three pinch bars. Out of the eleven hose, three could be used. I think the place for such supplies is in baggage and saloon cars.

Here each engineer has a set of tools. When they have to change engines they take tools with them. If a spare man is sent out to run for someone, he takes his pail, axe, saw, monkey wrenches, hammers, cold chisels, four fork wrenches, air pump and hose wrench, five oil cans, two lanterns, overall, and frock, and puts them into baggage car. You can imagine how a baggage car looks if four or five are sent out on one train.

I say, leave the tools on engine, and the engineer that loses or breaks one to report it. We sometimes change engines here, and it always takes from 10 to 15 minutes for men to take off their things.

J. A. Nute.

Northampton, Mass.

Metals and Molecules.

A remarkable article on "Recent Science" has lately been contributed to the "Nineteenth Century," by Prince Krapotkin, in which the writer remarks that we conceive of gases as consisting of an immense number of molecules dashing about in all directions, and that some such conception must now be formed of metals, whose molecules have a certain mobility—that, in fact, they never cease to move about and to enter into new and varied combinations. It is remarked that it is to the study of alloys that we are indebted for the forming of these views. It has become more and more apparent, says Prince Krapotkin, that a block of an alloy is quite a world, almost as complicated as an organ cell. Cylinders of different metals, as shown by the experiments of Professor Spring, may be so well welded together, at a temperature very remote from their melting points, that when they are afterwards torn asunder, by means of a powerful machine, quite new surfaces of tearing are produced, and new alloys are formed between two cylinders. Also it has been proved that solid metals evaporate from their surfaces exactly as if they were in a liquid state, or as camphor evaporates, while remaining solid, so that if we were endowed with a finer sense of smell, we could smell metal at a distance. Also Professor Roberts-Austin's brilliant experiments are mentioned, as the result of which it was proved that molecules of gold had traveled up a cylinder of lead, at the base of which it had been placed at a temperature of 135 degrees lower than that of the fusion of lead, and that the molecules of gold had lodged themselves amongst the lead molecules of their own accord. The author concludes, therefore, with Professor Roberts-Austin—that "metals have been sadly misunderstood," that they probably are never quiescent, and they deserve that the methods so fruitful for the study of living beings should be applied to them and their alloys.

Car Department.

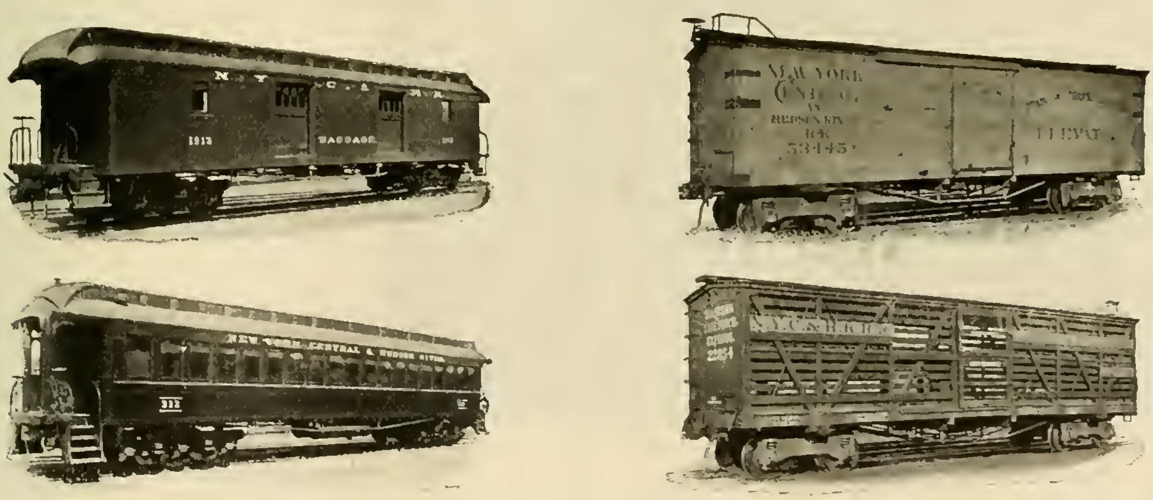
CONDUCTED BY O. H. REYNOLDS.

New York Central Freight Train.

The freight train hereby shown is the reproduction of a photograph taken while the train was passing the highlands of the Hudson on the New York Central Railroad. Trains of this kind are to be seen any day and they give a very good idea of the tremendous capacity of a fairly level railroad for the hauling of freight.

This train consists of sixty cars, which are drawn by a single mogul engine, having cylinders 19 x 24 inches. The empty weight of each car is 30,000 pounds, and it carries 60,000 pounds of grain. This gives a total load of 2,700 tons, handled easily and safely by a single locomotive. Reckoning the grain in this train to have been raised at the rate of 50 bushels an acre, the train contains the product of 1,200 acres of land.

NEW YORK CENTRAL FREIGHT TRAIN.



NEW YORK CENTRAL CARS.

Why Iron Axles Fail.

Iron car axles have been falling rapidly into disrepute during the last few years, and the cause has not always been in any inherent defects of the material. At a recent meeting of the Northwestern Railway Club, Mr. G. F. Hinkens, foreman blacksmith of the St. Paul & Duluth, gave some sensible talk on axles. As a practical blacksmith, Mr. Hinkens knows what he is talking about, and his words ought to bear great weight with those who are responsible for the safe operating of railroad rolling stock.

"We know," he remarked, "that the drop tests demonstrate a superiority of the steel axle, but there is often a vast difference between a drop test and an endurance test. It is like some of our young men who graduate with high honors. They do not always carry their honors with them on leaving school. When they enter the open field of trials, the real test begins. The graduating exercises and the drop test are both indispensable, but up to the present time neither of them are absolutely reliable, the boy fails, so does the steel axle. There are many reasons why axles fail; one of them, especially as to iron axles, 'too many irons in the fire,' which means overheating, underheating and hurried manipulation: the result, an inferior article. There is a limitation to the number of iron axles that ought to be made in a given time. Oftentimes quality suffers at the expense of quantity. In some places as high as 22 axles are made in ten hours: that means 44 heats. Now those 44 heats must come from the furnace good or bad, and that that many heats are bad, is beyond dispute. Would it not be safer and cheaper to make 16 axles in ten hours with the assurance that every axle was sound to the core, than to make 22 and have any misgivings?

"The 22 axle man may say that there is not one chance in a thousand of his axles failing. If that one chance should catch him, possibly he might be an axle maker in the next world. The traveling public wants safety. Give it to them, even if they must pay for it. If you injure one of them on account of bad material or workmanship, I assure you the railroad company will pay the price of a good many axles in a damage suit. I would rather spend money for good axles than for bad accident suits.

"Good iron axles are made, and can always be made, providing the material and workmanship are good. As a rule you get just what you pay for; if the article is good, so is the price. Eight thousand dollars will buy a great many good axles. I know of one case where that was the cost of one poor axle. It was a case of dear cheapness."

ERIE DAY COACH.

The Erie's New Through Train.

A passenger train, new and complete in every appointment that can be suggested to make travel a luxury, has been recently put in service on the Erie Railroad. The train is made up of five as handsome specimens of the car-builders' art as were ever turned out to please a discriminating traveling public.

First comes the regulation baggage car, but without platforms or platform hoods, having an exterior, similar in respect of the end finish, to the road's postal car which was illustrated in our July (1896) issue. The café car is next in the train, and has the same construction and finish at the platform and hood as the baggage car, which gives a uniform, business-like appearance to the two cars where they join, and is in perfect harmony with their position in the train, for the reason that about one-third of this end of the café car forms a baggage compartment for small luggage. Adjoining this is a smoking room, with portable cane easy chairs having heavy plush cushions, and also fixed seats upholstered with stamped leather and arranged with a comfortable distance between them for a table, that necessary auxiliary to the enjoyment of a little game The next compartment is devoted to the use of the chef and his assistants, and has all the modern appliances known to the culinary business; it takes up the width of the car, except space for an aisle by which the dining room is reached. Fig. 1 is an illustration of the interior showing the smoking room and exterior of the kitchen compartment.

The dining room occupies the remaining portion of the car, and has four tables with a seating capacity for 16 people. The seats are finished in embossed leather. Fig. 2 shows the cosy character of the surroundings in the view looking from the kitchen. The finish throughout the car, together with the mirrors plentifully interspersed, and the white head-lining, makes one of the brightest and most cheerful dining rooms imaginable. Beginning with this end of the car is the new wide vestibule with which the train is equipped.

The first-class coach is next, and is a decided innovation in interior arrangement, in having a large and finely appointed smoking and lounging room, which is over one-third of the length of the car. This room is entered from the end of the car, and is reached from the main part by a corridor at one side running the full length. The disposal of the seats is of the best for the enjoyment of the passengers, extending along the sides and ends of the compartment in the shape of commodious lounges with high backs, and a row of five Scarritt single reversible seats next to the windows. These seats are all upholstered in plain leather. Fig. 3 shows this room and its finish. The remaining portion of the coach is fitted with Scarritt seats finished in olive green plush, and will accommodate 44 persons. There is also a lounge seat with a high back in this section, running the full width of the smoking room partition. The view shown in Fig. 4 is looking toward the smoking room at the opposite end of the car. The car is fitted with toilet and lavatory conveniences of the finest, and the cherry finish throughout lends an air of quiet refinement not common to an ordinary first-class coach. A porter accompanies this car to look after the wants of passengers.

Two Pullman sleepers complete the train. One of these is a 12-section car, with toilet arrangements at each end, but has no smoking room, while the other is a 10-section car, with all the features noted above in addition to which there is a smoking compartment. These cars are built and finished in the usual palatial style of vehicles devoted to the service of the drowsy deity. The train in conformity with the sleepers, is equipped with the Pintsch light.

The painting and ornamentation of the exterior of the train is uniform in appearance, consisting of the Pullman standard color, and just sufficient gold leaf to leave an impression of tasteful elegance. This train, with the exception of the sleepers, was built at the Buffalo shops of the Erie Railroad Company, the cars having been designed under the supervision of Mr. A. E. Mitchell, superintendent of motive power.

When it comes to questions relating to the interchange of cars and the charging of repairs necessary when cars are away from home, there is not always the display of integrity and strict honesty between railroad and railroad that would prevail between man and man. There is a very strong tendency among the men in charge of cars to try and get the better of other roads whenever opportunity offers. In this connection it is pleasant to relate that the Boston & Albany people do not charge for the items credited on repair cards when it is decided to destroy the car. Old cars that have outlived their usefulness, when sent on a long journey, generally come back plastered over with defect cards, and very few roads have the justice to acknowledge that the car, and not the usage given it, was responsible for the defects.

The First Sleeping Berths in Cars.

An interesting bit of history is contained in the statement that the first practical and successful effort to use a folding berth in a car, was made by Mr. C. A. Smith, the well-known master car-builder. They were put in the short cabooses mentioned in the May issue of this paper, with the purpose in view of letting a little comfort into the lives of the train crews, who at that time had no adequate accommodations, simply a place in which to be protected from the elements, and devoid of anything likely to mitigate the hardships of railroading of those days of 1854.

These berths were hinged to the side of the car and folded up to same when not required for use, the same as is done today, differing only in the details and finish from the present sleeping-car practice, which they ante-date a sufficient length of time to justify the claim for originality. The idea was not thought to have any commercial value, as sleeping cars were unheard of at that time, and it was therefore not patented by Master Car Builder Smith.

Fuel Economy and Wind.

BY GEO. S. HODGINS.

(Canadian Pacific Railway, Windsor, Ont.)

If an everyday railway traveler were taken to the front of an American locomotive, and there asked to indicate the position which the signal flags, carried on the buffer beam, would assume when the engine was in swift motion ahead, he would probably answer that the flag would fly with the wind, and parallel to the line of rails, as the engine advanced. This answer would be incorrect, as any engineer could tell him. The flag really flies in such a position as to make an acute angle with the line of motion. It turns slightly towards an "across-track" position, so that if it had upon it a star or letter, such device could be seen by an observer standing upon the track, some distance ahead, and watching the approach of the train. The reason for this midway or quarter position of the signal is, that as the engine rushes along, the air which strikes the smokebox is driven out at each side so rapidly and violently as to blow the flag a little sideways, and the faster the speed, the more across-track the position of the signal. The pressure of the atmosphere against a moving train is thus made apparent by the fluttering bit of bunting at the front.

In these days, when the important question of fuel economy is engaging the attention of railways all over this continent, the consideration of the air pressure upon a train is bound to be a factor in the problem. It may, however, be contended that taking two or three engineers, with engines of similar construction, and approximately in equally good condition, engaged in pulling trains of average weight, at a definite speed, daily, that each one (taking the bitter with the sweet), for a month or more, will probably encounter as nearly as may be the same resistance of air. Therefore, that factor being practically constant, may be disregarded and left out of consideration altogether. It is impossible, of course, to tabulate the wind resistance, the effects of rain, sleet and snow, and all the many minor differences which affect each trip. The nature of the case demands that any set of figures representing locomotive performance shall be made up by a series of compromises and averages which are as fair to each one concerned as human ingenuity can suggest. In practice we know that the effects of varying weather on the performance of an engine are so puzzling and complicated as to be beyond our present skill, and, in fact, these effects are never closely analyzed, and the results tabulated at the end of the month are consequently only approximations to the actual truth. There is, however, one aspect of wind resistance which might with perfect fairness be introduced, and one which may possibly be capable of a satisfactory adjustment on the performance sheet.

CAFE CAR, ERIE TRAIN.

The "Pall Mall Magazine" for March has a popular explanation of the different types of locomotives, and the relative performance of most of the modern express engines used in great Britain, from the pen of Mr. Herbert Russell. One point brought out by the writer is worthy of note. He explains why it is that the "red-racers" of the Midland are able, with boiler pressure, cylinder capacity, wheel dimensions, road gradients and train weight all, as nearly as can be, equal to those of the Great Western, yet can and do beat the Swindon machines. We are informed that the Midland drivers receive a premium for keeping time. As a Midland man expressed it: "Be in to the minute, and blow the expense, is our orders." On the Great Western Railway the drivers receive a premium for economy of coal and oil. Without criticising the policy of either company, the result is plain. It is, however, quite safe to say that nearly every railway company on this continent would prefer the happy union of the good points in both systems.

Molesworth, in his "Pocketbook of Engineering Formulæ," gives the pressure per square foot produced by air in motion, from a hardly perceptible breeze up to a hurricane. The pressure for a pleasant breeze of, say, 15 miles per hour is given at 1.107 pounds. An engine moving through tranquil air at that rate would, of course, encounter that pressure. If it moved at that rate, and the breeze was blowing at the same time, but in an opposite direction, the total pressure would be equal to that of a high wind upon a stationary object, viz., 4.428 pounds per square foot. The performance of an engine moving at 15 miles per hour against a breeze of 15 miles per hour, would approximately parallel the performance of the same engine moving 30 miles per hour in tranquil air. It is easy to see that, though this is a rough calculation and does not take into consideration all the conditions, strains and stresses incident to accelerated speed, it yet offers, as our clerical friends might say, much food for thought.

SMOKING CAR OF ERIE DAY COACH.

In trying to justly estimate the "personal equation" of the occupants of the cab, and especially that of the engineer, his desire, or the reverse, in regard to making up time, might fairly be considered. If a man gets hold of a train fifteen or twenty minutes late, and "goes in on time," even though the air be quite tranquil, he has greatly increased the wind resistance of his train. He has, in fact, artificially created a wind storm, with which he battles. If he does so at the desire of the company he serves, in these days of keen competition, it is beyond human nature for him not to feel himself a little superior to a man who takes hold of a late train and brings it in late at the terminus. It is not necessary for a company to give premiums for time-making. If it can be so managed that the man who makes up time will receive credit for it on the performance sheet, he will feel well paid for his trouble. The man who makes up time has certainly burned more coal, but he has done more work with it than the strictly scheduled time runner. He does not always have this extra work considered, and at the end of the month his fuel consumption is higher than that of the other. The maker-up of time, therefore, appears to be the more extravagant man of the two, while the real fact may be otherwise.

A run of 120 miles, done in three hours, with five passenger coaches, means an average speed of 40 miles per hour, and the total car mileage for the run is 600. If this trip be made, as occasion demands, in two hours and forty minutes, it means that the speed has increased to 45 miles per hour, twenty minutes have been made up, and more coal has been burned. The car mileage for the trip is in each case exactly 600. Now, the car mileage divided into the coal consumed, would show that the man who, when late, kept late, was the more economical of the two, and so he most undoubtedly is, when these considerations alone rule. If, however, we consider car mileage not by the trip, for then it is constant and definite, or as a monthly total, but look at the car mileage made per hour by these two men, we will see that the man who made up time has made 225 car miles per hour, while the other has only made 200. The car mileage per hour being used as the divisor, and the amount of the monthly coal pile which each has to account for as the dividend, then it is evident that the man who burned more coal in doing useful work has the larger car mileage per hour to offset the performance of his slower friend. It is not possible for either to have, with same cars, and on same division, any difference in the car miles per trip; but when the car mileage per hour is taken, it may be found to vary directly as the coal consumption, and to be a fairly workable and just method of estimating performance. There is, no doubt, an equation subsisting between work done and coal burned, for similar trains, engines and divisions. The simple car mileage used in total does not altogether appear to satisfy the terms of that equation; but car mileage per hour, divided into total coal consumed, and tabulated in an extra column on the performance sheet, might be somewhat more equitable and satisfactory, where nearly similar conditions prevail.

Air-Driven Buffing Tools.

At the West Detroit shops of the Michigan Central Railroad, they have fitted up an old hoisting engine that had lain around rusting for years, into a motor for the buffing tools for cleaning and polishing all bright metal coach trimmings. The cleaning plant is several hundred feet away from the steam supply, and owing to this fact it was decided to use air for the motive power to drive the tools. The air supply is abundant at 100 pounds pressure, and since the engine requires but 15 pounds to handle the buffers, some cabinet shop tools are to be installed at a convenient point near the engine to get the benefit of the reserve power. A delightfully cool atmosphere results from the exhaust of the engine, which fact helps to make friends and find openings for the introduction of the new power for summer uses at points remote or near to the steam boilers, saving shafting, pulleys, couplings and hangers.

LIBRARY AND SMOKING END OF CAFE CAR.

The Beginning of Organized Wrecking Service.

The birth of wrecking organizations on railroads, that is, special crews set apart for the purpose of handling and clearing up wrecks, dates from the year 1865 on the Erie road. Mr. C. A. Smith, who was at that time the master car builder of the Erie system, is the author of the move looking to a more complete and satisfactory disposal of the problems arising from wrecked equipment.

A reliable man was appointed to supervise a gang of laborers of his own choosing, and a car was built for their convenience, furnished with bunks and stoves, and equipped with wrecking apparatus comprising switch ropes, jacks, wrenches, axes, hammers, etc. The present system, copied from this, is hardly more complete or efficient than the one of thirty-two years ago; may get out a little sooner, but do no better work aside from that.

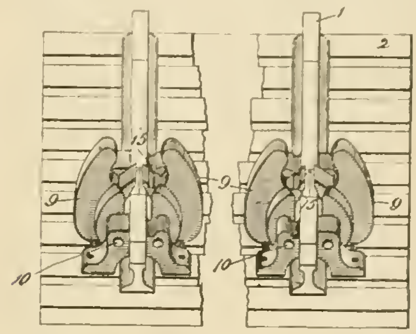
The practice has hitherto been universal in Europe of keeping one crew upon locomotives, but now the "pooling" fever has reached England and the enginemen are by no means pleased with the idea.

Car Wheel Chock.

The annexed engraving shows a new form of car wheel chock invented and patented by Mr. C. Wilhelmsen, roundhouse foreman Illinois Central Railroad, Jackson, Miss.

The chock is designed to do away with the present form of cumbersome and expensive bumper usually erected to catch cars at the end of the track. It is a very simple device and consists of a pair of jaws placed upon the track. When the wheel enters the jaws, the latter act automatically, positively gripping the wheel in such a manner that the movement is checked and the wheel anchored to the rail.

The inventor, writing to us about the car chock, says that it has been invented



CAR WHEEL CHOCK.

specially for terminal stations, side tracks, transfer boat tracks and inclines. When a car gets onto the chock, the large jaws close on the wheels and the smaller ones are spread by the wheels and catch the rail under the head. It does not need to be fastened, as it holds onto the rails when cars are run onto them. It seems to be a useful device and will, no doubt, in time become a substitute for the existing car appliances.

In a French contemporary, M. Levat recommends the use of carbolic acid for tempering steel tools. In testing two cold chisels, he tempered one in water, the other in a solution of carbolic acid, after both had been heated to a cherry red. The chisels were set to work on extra hard wrought iron. The one tempered in water became notched after a short time, the one tempered in carbolic acid remained perfectly intact. The second test was made with two puddle steel bars, which were heated to white heat and tempered in water and carbolic acid respectively. The bar tempered in carbolic acid showed a much finer fracture, which reflected like a mirror when filed. The carbon contents were not increased, but in the bending test the bar tempered in carbolic acid showed more elasticity and pliability than the other, while its hardness made it most suitable for tools.

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Personal Changes.

With this issue, Mr. John A. Hill, who was the first editor of the paper, severs his connection with "Locomotive Engineering" to become President and Treasurer of the "American Machinist." This change leaves Mr. Angus Sinclair sole proprietor of the paper, and for business convenience it has been incorporated into a joint stock company, called the "Angus Sinclair Company."

We are pleased to announce that although Mr. John A. Hill severs his business relations with the paper, that his versatile writings will still grace our columns. In inspiring writing on mechanical subjects with alluring interest, Mr. Hill is second to no man who has ever put his pen to paper, with perhaps the exception of Mr. James W. See, who wrote "Chordal's Letters" years ago. It is therefore very gratifying to know that the reading columns of "Locomotive Engineering" will not suffer from the change.

An addition to our editorial staff has been made by Mr. Fred. H. Colvin, for several years editor of "Machinery," joining our force. Mr. Colvin is a young man with a great deal of engineering and some editorial experience, and we feel safe in promising that his work will add considerably to the interest of the paper.

For Auld Lang Syne.

With this, the June issue of "Locomotive Engineering," I shall retire from active participation in its affairs. In doing so I wish to express my regard for our readers and gratification for their friendship and sympathy in the past.

I was the first editor of the paper and for four years its only one. For the past six years my associate and myself have worked together in harmony and received that hearty support always given to earnest efforts in the right direction.

I am proud to believe that "Locomotive Engineering" has done much good to the men in the mechanical departments of our railroads and helped to make them, as a class, greater readers and students of useful knowledge than they were ten years ago.

The business has grown wonderfully, and is now of such a magnitude as to be better handled by an incorporated company than by individuals, and the "Angus Sinclair Company" will carry on the business, with Mr. Sinclair at its head.

For the past year and a half most of my time has been occupied in the active management and treasurership of the American Machinist Publishing Company, of which Sinclair & Hill were the principal stockholders. I shall hereafter devote all of my time and such abilities as I may have to the management of the "American Machinist," having assumed the office of President and Treasurer.

One of the pleasantest recollections of my connection with the paper has been, and always will be, the kindly reception of articles by "John Alexander" and "Skinney Skeevers," that I may as well now confess to writing. This pleasure I do not intend to entirely forego and hope to accasionally speak to the "Locomotive Engineering" readers again through that channel.

In the hands of Mr. Sinclair and his associates I feel that the destinies of my child, "Locomotive Engineering," will be safe and I bespeak for them the good-will, support and encouragement always accorded me by my old dear friends and companions of the footboard and shop—"the boys."

JOHN A. HILL.

Steam-Jacketed Cylinders.

It is wonderful the amount of effort and ingenious labor there are devoted to trying to do things that are proven to be impracticable. A locomotive is a peculiarly inconvenient engine to change from its ordinarily wasteful habits, and nearly every invention conceived for improving the engine has been tried, but there are some conspicuous sources of heat loss that seem beyond remedy. The efficiency of all steam engines is seriously diminished by the condensation of steam in the cylinders, and the locomotive appears to stand near the head of the list as a delinquent from this habit. The attempts to provide a remedy for locomotive cylinder condensation have been very numerous, but failures do not seem to deter new soldiers of invention from throwing their labors into this breach of certain failure.

Considering the magnitude of the loss of heat due to condensation and re-evaporation in the cylinders of a locomotive, it is not surprising that many of the best engineers and inventors have labored to devise a preventative. With slow moving low pressure engines the loss from cylinder condensation is so great that James Watt, the famous engineer, calculated that three-quarters of the steam was wasted by this cause. The fact is well established that from 20 to 30 per cent. of the steam which passes through the dry pipe to the cylinders of locomotives becomes watery vapor before doing any work upon the piston, and it is then incapable of doing work unless more heat is given it. The cylinder condensation of some engines of bad design is as high as 50 per cent. During the stroke the inert vapor mixes with the steam, and when release takes place and the reduced pressure occurs the vapor flashes back into steam, increasing the volume to be exhausted, and therefore increasing the back pressure. That looks like a sort of far-fetched theory, but its truth has been established by too many carefully conducted experiments to be gainsaid. It is then no wonder that inventors have striven to devise some means to keep the cylinders as hot as the incoming steam.

The most common attempt at preventing cylinder condensation has been by means of steam jackets, which have been fairly successful when applied to stationary engines. The most common form of steam jacket is a hollow casing around the cylinder into which live steam from the boiler is introduced with the object of keeping the walls of the cylinder hot. When properly applied this has worked pretty well and has no doubt saved steam, but in some cases the reverse of saving has been the result. Unless the jacket is promptly and regularly drained of the water of condensation, instead of a heat server it becomes a condenser which increases the chilling effects within the cylinder. The history of steam engine practice tells of many cases where steam jacketed cylinders have acted as condensers, instead of heaters, with very disastrous effects on the consumption of coal; but it was the fashion at one time to consider that the steam jacket must *per se* effect saving of heat and very little investigation was made to ascertain its real action. In climbing over a very extensive grade, the knowledge came to most engineers that steam-jacketing was an arrangement worthy of careful watching and there are now few steam users that employ this cylinder attachment without trying the difference in performance when the jacket filled with air and then with steam.

When the recess between the casing and the cylinder is kept filled with dry steam there is no doubt that it not only prevents initial condensation—that is, the condensation that results from the steam entering a body colder than itself—but it restrains the condensation due to the loss of heat resulting from the steam doing the work of pushing the piston. It might appear that taking steam out of the boiler to maintain the cylinder hot would be a process of robbing Peter to pay Paul, but in this case a big discount is made. Ten per cent. is made to pay two or three times its face value.

Where steam-jacketing is successfully followed, the water of condensation in the jacket is invariably returned to the boiler carrying its remaining heat to the source of steam generation.

Steam jacketing has been applied a great many times to the cylinders of locomotives, but so far as we can ascertain, no saving has resulted, and in most cases there was absolute loss. The subject has received new life lately by the increasing number of compound locomotives in use. When compound locomotives first began to come into service Mr. Alexander Borondine, an eminent Russian locomotive engineer, made a series of tests to ascertain the effect of steam-jacketing of the cylinders. At first the engine was jacked up in the shop and a brake applied to produce the necessary resistance. In these tests he found that jacketing effected a saving of from 16 to 13 per cent. But when the same engine was put into road service the saving disappeared and loss of efficiency instead of gain intervened. This the experimenter attributed to the water of condensation not being properly drained converting the jacket recess into a veritable condenser.

That is the difficulty which has been found insurmountable. If there is difficulty in properly draining the jackets of stationary and marine engines, the locomotive becomes almost hopeless. Many experimenters in this line of improvement were in the field before Mr. Borondine and others have followed him with the same discouraging result. The impracticability of draining the steam jacket recess to keep up with the turning of steam into water has converted expected gain into loss. Thus a source of steam-saving that can be applied to stationary and marine engines is debarred from use on the locomotive.

Our Express Trains and Locomotives.

The leading cities on the American Continent had no sooner been connected together with the iron screws of railroads than a demand arose for the running of express trains that would transport passengers from city to city in the least possible time. The dream of the early advocates of the steam engine as the means of motive power on land transportation was, that it would be capable ol doubling the speed made by stage coaches, and that its use would enable travelers to go from place to place at the unparalleled speed of fifteen miles an hour. When reports of actual performances began to reach the ears of the people, and reputable reports were made that certain trains had been run at a speed of thirty miles an hour, the ambition of the traveling public kept more than pace with the progress made, and it was not long before the demand arose that trains should be run at a mile a minute. Those were the days when the gospel of mechanical marvels found many converts, the days when the conviction abounded that the resources of American engineers were equal to the difficulties of overcoming all physical and natural obstacles, and that the moving of the fixed stars, even, was within the control of that newly harnessed marvel, the potency that comes from the force of expanding steam.

It is now over one hundred years since Oliver Evans, the inventor of the high-pressure, high-speed steam engine, predicted that the time would come when his engine would enable people to travel so fast, that they would leave Washington after breakfast and pass over the 230 miles in time to sup in New York. Most people regarded this as the ideas of an impractical visionary, but the first link joining important cities by railroad had no sooner been built than the people began to demand that Evans' ideas of train speed should be doubled.

A significant circumstance in connection with that demand was, that the locomotive was always kept equal to any speed requirements put upon it. The only obstacles to running trains at modern speeds fifty years ago were the weakness of the track, which could not safely resist the shocks of sixty miles an hour speed; the want of signals to guard points where trains might be found unexpectedly, and the absence of efficient means of stopping the trains.

The early locomotive designers made the mistake that the size of driving wheels was the element that controlled the capacity for fast running, and under this delusion many locomotives were built during the second decade of the railroad era which had a single pair of driving wheels from 6 to 7 feet in diameter. About 1850 there was an active agitation in favor of running trains that would make a running speed approaching a mile a minute, but the movement in that direction was short-lived. That was the period when the truth first dawned upon railroad managers and master mechanics that fast running and the pulling of a paying train did not go together. One side also learned that not the size of driving wheels, but the size of boiler was the element which made continuous high speed possible. This was a lesson of practical engineering early learned and never forgotten. Its influence was exerted in favor of large boilers in proportion to cylinder capacity. At the same time, the truth became recognized, that an engine with a pair of coupled driving wheels about 5 feet diameter could out-distance the inert engines with 2 feet larger driving wheels in the general train service, that called for stopping and starting every twenty miles at the least.

This brought into favor the "American" eight-wheel engine, which was equally well suited for all kinds of train service, and was the best all-round engine the railroad world has ever seen. Although special forms, such as ten-wheelers, moguls, consolidations and other types of locomotives have been largely introduced within the last ten years, the eight-wheel engine is still greatly in the majority, and has no rival, within its capacity, for comfort and efficiency.

The "Stourbridge Lion," the first locomotive to turn a wheel upon an American railroad, had not been imported ten years, when more efficient engines were in use that were reported to run at a mile a minute speed with a light load. That was a velocity that caught the popular imagination, and that was the speed that the traveling public have ever since demanded of railroad companies. While the demand has been made persistently enough, those who wished to enjoy the luxury of excessively fast travel have never displayed an inclination to pay for the extra expense incurred in moving trains at the velocity desired; and so the railroad managers, past and present, contented themselves by running trains at the speed which produced the best revenue. Since railroad companies have demonstrated that they could run paying loads at a speed over 60 miles an hour, the public demand has crept up in favor of 100 miles an hour pace; but the inclination to pay for the cost of the long-demanded 60 miles an hour speed has made very small progress.

On our leading lines, locomotives, track, train protection and stopping power are all sufficiently perfected to enable the railroad companies to run trains at an average speed of 60 miles between starting and finishing points; but the men in charge receive no encouragement to engage in any such enterprise. It is so difficult to get passengers to pay the small extra charge on limited trains that cover long distances at a speed over 40 miles an hour, that there is no use in railroad managers demanding the extra sum necessary to pay for 60 miles an hour speed, for they would not receive it. The only popular long-distance train that we have with a speed over 50 miles an hour is the Empire State Express, on the New York Central, and it is an exceptional train, as it runs between two great cities through the most densely populated district in America.

When passenger trains began to be run over the weak track of the pioneer period, the average speed seldom exceeded 20 miles an hour, and on most lines the speed was considerably less. But the acceleration has gone on steadily, and was kept as high as possible consistent with safety, until now most of our express trains maintain between terminals a speed over 40 miles an hour. The first radical mechanical improvement, which made modern speeds possible and safe, was the invention of the Westinghouse air brake. The application of that great invention to trains put them under control, and speeds that previously would have been invitations to disaster became perfectly safe.

Our average express train speeds are not so high as those in Great Britain; but the weight of our train loads is far greater, which is undeniable testimony in favor of the efficiency of our locomotives. When the famous train-racing between London and Aberdeen was going on, two years ago, the trains seldom reached a weight of 100 tons, exclusive of the locomotive. When the New York Central made a test to see if their motive power could equal that of the engines which pulled the trains from London to Aberdeen, they put on a train weighing 175 tons, and beat the best time made by their foreign rivals. The ability to achieve this performance is not confined to the New York Central. The later types of the Pennsylvania Railroad passenger locomotives are quite as powerful as the other road, and there are few first-class railroads on this continent which do not have locomotives that would equal the performance of those that made the unparalleled record of pulling a train of 175 tons 440 miles at an average speed of 64¼ miles between start and finish..

There is no mystery about how our locomotives are capable of hauling such heavy trains at excessive speed. The largest passenger locomotive in Europe has about 1,400 square feet of heating surface. Our modern engines of similar cylinder capacity have about 2,000 square feet of heating surface, and grate area in proportion. The boiler is the lung power of this fleet horse, and the race is with the engine that can turn most water into dry steam.

Carrying Bicycles.

The various State legislatures continue to pass laws requiring railroad companies to carry bicycles free, and the indications are that these requirements will soon become general. We do not believe that a sense of justice actuates any of the politicians and legislatures who advocate the passing of these laws, but we believe also that railroad companies have adopted a very short-sighted policy in throwing obstacles in the way of bicycles being carried. It is safe to say that every bicycle carried on a train means an extra fare to the railroad company, and the few companies that have encouraged the carrying of bicycles have received substantial benefits from increase of travel.

If railroad companies doing suburban business would adopt a more liberal policy towards bicycle riders, they would profit from the same. It would cost very little to put up houses at the leading stations, where bicyclers could leave their wheels when going to business in the morning and find them safe on their return. This privilege would enable the wheel rider to live farther from the station without inconvenience, and the tendency would be to draw more patrons to the railroad company.

None of the railways grant this inexpensive favor, however, but the wiser and craftier commuters have discovered that by taking their wheels into the city with them every day, they can get free storage for it at the urban terminus, and ride home from their own station every night, with no more trouble to themselves than if the thing were done in a simpler way. This practice is rapidly spreading in commuter circles, and it causes a vast amount of wholly unnecessary labor to the railroad employés. Sooner or later the companies will see that it costs no more to grant storage privileges in Lonelyville than in New York, and then another step in the march of progress will be taken.

Showing Difference of Fuel Consumption of Locomotives.

The Canadian Pacific Railway people are making a persistent and systematic effort to reduce the fuel consumption of their locomotives. They have supplied their enginemen with the best literature they could find concerning combustion, and they are now pushing the men to do their best to reduce the quantity of coal necessary in doing the work.

One part of their system consists of making a monthly record of the fuel consumption of engines on different divisions. Engines of the same size and class are grouped together, and the best record for fuel economy is printed at the top of the list, with the name of the engineer and fireman against it, and the number of miles run and the cost of fuel per car mile. Against the name of the engineer and fireman of each other engine is shown the extra expense for fuel they incurred above the best record. In some cases the difference is so great as to be remarkably striking. In a list of thirteen engines, with cylinders 18 x 24 inches, on the Toronto Junction division, the average loaded car mile per month being about 80,000, the man having the worst record used $138 worth more fuel than the man who made the best record. Of course, the engineer and firemen are not absolutely responsible for the extra consumption of coal, as the engine that is in bad order uses up a great deal more coal to do a certain volume of work than the engine in good order, but it is a very fine kind of an object lesson. It will show the company several things besides the advantage of having engineers and firemen perform their work carefully and skillfully.

It will demonstrate, for one thing, the poor policy of running an engine that is worn down until valves and pistons leak, wheels are not of the same size and boiler choked up with mud. An engine of that kind is a very expensive luxury, and the sooner that railroad companies can be shown clearly how much extra it costs to run engines in that condition, the better it will be for those who have money invested in railroad property.

Broken Rail Joints.

We should like very much to know why some railroad companies lay the rails on their main lines with broken joints—that is the joint on one side coming opposite the center of the other rail. Where the rails are laid in this way the cars receive an oscillatory motion which is very disagreeable. On stretches of track where there are many low joints the oscillation of the cars becomes so bad that walking along the aisle is difficult. The cause of this swaying motion is that the wheels on one side descend into the joint depression while those on the opposite side are on the ridge portion of the rail. Then the wheels on that side go down into the joint trough and the others remain up. This soon sets the trucks swaying and they impart that motion to the car. The writer once rode a long journey over a railroad with broken joints in the cabs of Wootten engines and the pendulous motion was at times alarming to one not accustomed to riding in a cab elevated eight feet above the rail. The experience had the effect of emphasizing a long established dislike to broken joints.

The discomfort imposed upon passengers by a swaying car ought to be sufficient cause for condemning the broken joint plant, but there must be another serious objection to it since the swaying motion tends to make the truck wheels run with a sinuous motion that materially increases the flange friction. This entails greater train resistance and increase of fuel consumption besides shortening the life of the wheels.

The question of broken rail joints was warmly discussed by some of the engineering societies years ago when the practice was first introduced. No good reason was ever advanced in favor of the plan and we do not think it has been adopted for any better motive than the desire to be odd. Like nearly all other oddities it is an expensive luxury.

Tight Pistons and Lubricating Oils.

A matter which has received less attention from railroad men than its importance deserves is the loss of useful work absorbed by the friction of piston rings. The prevailing idea about piston rings is to put all the pressure possible upon them, so that they will press tightly upon the walls of the cylinder and prevent leakage. Too great a price may readily be paid for this means of preventing leakage. The sound process in this regard ought to be to make the rings press as lightly as possible on the cylinder face consistent with making a steam-tight connection. We believe that much of the trouble caused by cut cylinders and broken piston rings is due to the piston rings being fitted too tight.

A few years ago Professor Denton, of the Stevens Institute of Technology, Hoboken, N. J., made a series of careful tests of the friction of piston rings, and his discoveries ought to be useful to other engineers. He found that when a piston ring was set to press upon the cylinder 65 pounds per square inch that the friction absorbed 7 per cent. of the work the engine was capable of performing had there been no piston friction.

The discoveries about the use of lubricants were even of more import to the railroad officers who are putting inordinate pressure upon locomotive engineers to use so little valve oil that this sort of lubricant is becoming more valuable than its weight in silver. Experiments were made feeding the cylinder with varying quantities of lubricating oil, and it was found that the friction steadily decreased with increase of the lubricant. With half a drop of oil per minute it fell to 3 per cent., and with two drops of oil per minute the coefficient of friction fell promptly to 1 per cent. Two drops per minute were sufficient, and a greater supply did not reduce the friction.

The tests were made with a small stationary engine running a light load, and do not apply directly to locomotive practice; but valuable lessons can be learned from them. The most obvious one is, that niggardly use of valve oil puts a liberal drain upon the coal supply. Proportionately, coal costs more than oil, and the cheaper article ought not to be saved at the expense of the dearer. This is largely done, nevertheless. The railroad official who is ready to boast about great saving in lubricating oils is treading on dangerous grounds.

A Magnificent Book.

In another column will be found the advertisement of "The World's Railway," which we believe will interest every reader of "Locomotive Engineering."

This book cost a large amount of money, and was destined to sell at a very high price. The author spent a great deal of time in collecting the data and verifying his facts, and one of the best mechanical artists in America spent about two years on the engravings.

Only one edition of the book has been printed, and that has come into the hands of "Locomotive Engineering," and will be distributed to its railroad readers at less than half the cost of the book to the printer.

It all came about in this way: Mr. J. G. Pangborn, who had charge of the B. & O. exhibit at the World's Fair, showed a great deal of ability and activity in getting originals, models, pictures and data from all over the world, of early locomotives and cars.

After the Fair, this great exhibition of models and original engines formed the nucleus of the Field Columbian Museum, devoted to transportation subjects, now located permanently in Chicago. This museum sent a commission around the world to gather engines, pictures and other data to make the Columbian Museum the best in the world, of its kind, which it undoubtedly is, and all the matter thus gathered was open to the author and artist of this work for all the use to which they could put it.

The B. & O. R. R., being the originators of the work, took a great interest in the matter—not because the book referred so much to the B. & O. road, because it is entirely impartial, and gives credit where it is due the world over, but because a great many of the original experiments and early developments were carried on by the B. & O. The officers of the road ordered an edition of one thousand copies of the book, which they expected to donate, with their compliments, to the prominent railroad men in this country and abroad.

But "the best laid plans of mice and men gang aft agley": Mr. Pangborn did not return to America from his trip abroad, but remained in Russia for a long time. The printers got this magnificent edition of the book out, and the B. & O. road went in the hands of a receiver. The printer found himself in possession of an edition of a work that cost him in the neighborhood of $16,000, for which he had not received anywhere near all his pay; the B. & O. road changed officials, and a long delay occurred, which caused the printer as well to go into the hands of a receiver.

When these conditions occur in any business there is an opportunity for somebody with the ready money to get a bargain. "Locomotive Engineering" had the money, and has the edition of this work, and is going to sell it to railroad men at a very low price., i. e., $7.50 per volume, the buyer to pay express.

An edition de luxe of 150 copies, printed on Japan hand-made paper, sold at sight for $25 per copy. The present edition of one thousand is printed on the finest plate paper; the size of the page is 11 x 14 inches; there are over three hundred engravings, one hundred and fifty-four of these being in three colors in neutral tints, hardly any two of them the same. The book is bound in rough leather, gold type, gold top and rough edges, and is without doubt as handsome a piece of work as was ever turned out of a press.

As this is the only edition printed, or to be printed, there is no doubt that, with time, each one of these books will become more and more valuable as it becomes more and more rare. Every railroad man who wants to get the history of the development of railroads and the pictures of all the experimental engines from the start to the present day, with all the facts and data briefly and tersely given, cannot afford to miss this opportunity.

It is not often that we speak so strongly about a book of any kind, but this book is so valuable, so handsome, and we consider it so great a bargain to readers of "Locomotive Engineering," that we cannot help indorsing it as we do.

We do not believe that any railroad man can get it for this price and be disappointed.

BOOK NOTICES.

"Hydraulic Machinery, with an Introduction to Hydraulics." By Robert Gordon Blain, M. E. Spon & Chamberlain, 12 Cortlandt street, New York. Price $5.

This is a book of 383 pages, 8½ x 5½ inches, profusely illustrated with excellent engravings Hydraulic appliances are coming so much into use for the transmission of power in all kinds of industries, that a work relating to them, written in a clear, lucid style is certain to find many readers. This book certainly possesses these merits. It is very comprehensive and appears to treat of all kinds of hydraulic machinery in use. The purpose of the author was to produce a book of moderate price, containing really sound information, couched in language that ordinary students and readers could understand, and he has carried out his purpose very well indeed. The book is divided into 31 sections, and each one is quite exhaustive of the subject treated. Among the sections are "The Hydraulic Press"; "Hydraulic Jack"; "Applications of the Hydraulic Press"; "Water at Different Velocities"; "Measurement of Flowing

Water"; "Jet Propulsion"; "Turbines"; "Hydraulic Engines"; "Hydraulic Machine Tools"; "Hydraulic Rams"; and others of similar character. We can conscientiously commend this book to everyone interested in hydraulic machinery

We have received the third part of "Easy Lessons in Mechanical Drawing and Machine Design," by J. G. A. Meyer. This number fully fulfills the promise of the earlier numbers and carries the student along in a fashion that will soon make him a draftsman if he practices the teaching with sufficient industry. Besides the figures and description of methods of drawing, there are data about figuring certain mechanical devices such as the diameter and speed of pulleys, and other shop questions. There is a good description of the elevating slide rest with taper attachment, which is very finely illustrated. Then there is a section on change of gears for screw cutting, which is very exhaustive. Our readers will probably remember that this fine work is being published monthly by the Arnold Publishing House, 16 Thomas street, New York.

The Rogers Locomotive Works' Catalog.

A new illustrated catalog has been published by the Rogers Locomotive Works, Paterson, N. J. It is a book of 120 pages, 8 x 11 inches, and contains a great many very finely produced engravings of the locomotives built by the company, besides views of the works and a portrait of Thomas Rogers, the originator. A short history of the Rogers Locomotive Works is given, from which readers learn that the works were established in 1831 and have been building locomotives since 1837.

The catalog contains a general description blank used in giving dimensions, weight and other details in the construction and equipment of what are called the Rogers standard locomotives, and a copy of specifications for the material used. There is a very handsome article on the tractive power of locomotives prepared, if we mistake not, by Mr. M. N. Forney. The old Clark formula is given for finding train resistance, which is thoroughly unreliable and entirely out of date. There is a table and diagram given showing the difference between boiler pressure and the average effective pressure on the piston for the whole length of the stroke. That table and diagram will be found exceedingly useful by those who have to calculate the hauling power of locomotives at different speeds. There are a variety of other tables relating to dimensions and capacity of locomotives under different conditions, all of which will be very convenient to the railroad men fortunate enough to receive this handsome volume.

Schenectady Locomotive Works' Catalog.

A very handsome illustrated catalog has been published by the Schenectady Locomotive Works. It is a book of the standard size, 6 x 9, and contains 224 pages, in which there are about 100 half-tone illustrations of all sorts of locomotives built by the works. They are very finely made engravings, and the book looks exceedingly artistic, besides containing a great deal of valuable information for motive power men.

The latter part of the book is devoted to giving information about train resistance and power of locomotives. The usual formula for finding the power of locomotives is given, besides a variety of tables giving the tractive power of engines of various dimensions. They are the most complete tables on this subject that we have ever seen. Other tables give number of revolutions of driving wheel per mile, piston speeds in feet per minute at engine speed of ten miles per hour, resistance of trains in pounds per ton for various speeds and grades, and the horse-power required per ton for the same.

Those who have to make calculations about the power of locomotives will find this book an exceedingly useful reference.

Reports of Men Wanted for Japan and China.

We have received a great many requests lately for information about parties who are hiring men to go to work on railroads in China and Japan. We made exhaustive inquiries to find if men were wanted for these railroads, but could obtain no information of a positive character until we applied to Burnham, Williams & Co., of Baldwin Locomotive Works.

They write us regarding the report of men being needed for Japan: "We desire to say that the report is entirely unfounded, and we will thank you to deny same in your columns. We have been flooded with letters from men who have heard this report and are seeking employment. As a matter of fact, the contrary is the truth, as the Japan Railroad is discharging all foreigners in their employ."

We might add to this, that the same is true in regard to China. No men are wanted for the railroads in that country.

Brake Beams.

Not a few railroad men are very much surprised over a statement made by Mr. Sanderson, of the Norfolk & Western, to the effect that he had examined a lot of brake beams, both of metal and timber, which had been tested to destruction, and he found that the wooden beams stood the test better than any of the metal beams.

It is to be regretted that the information was not given of what metal beams were tested, for it is easy to be seen on examination of the multitude of metal beams now on the market, that some of them are of very poor design. If a wooden beam is better than a good metal beam, the railroad companies that have adopted metal beams have made an expensive mistake, for it costs from $4 to $5 a car more for a good metal beam than one of oak. We doubt, however, that metal beams, even though greater in first cost, are not cheaper in the end than wooden brake beams.

Every time the mechanical conventions have met at Old Point Comfort an amusing little fraud has been enacted upon the lady visitors, and we suppose the same thing will be done at the conventions which meet there this month. The way the thing is done is that someone whispers into the ears of the visitors that moonstones can be found on the beach of the bay. Then the visitors in petticoats swarm along the edge of the water, looking very wistfully at every little pebble to be seen. Then they pick up the best-looking pieces of quartz and imagine them to be moonstones or even more valuable gems. A lapidary has a shop near the hotel and the information is given that the stones can be cut while the visitors wait. The lapidary takes the stones and substitutes for them other cheap jewels found in the Black Forest and cut in Germany. Then the ladies go away happy, with the consciousness that they have found jewels that are good enough to make presents for their friends at home.

There is something strange in the way that women act towards smoking cars in cities where these are run on street railroads. The usual practice is to leave two or three seats in the rear for the accommodation of smokers, but we notice that they are nearly always half filled with ladies. Last year, the Metropolitan Railroad Company, of New York put on cars for the special accommodation of smokers, and they were nearly always filled with women. This year a deputation of females found influence enough with the company to abolish the smokers, and give two seats in the rear for those who wished to smoke. We notice now that the small amount of accommodation is nearly always occupied by women, and yet they complain that smoking is a nuisance upon the cars.

The Baltimore & Ohio Railroad recently adopted the Pintsch light for all their passenger equipment, which requires the erecting of gas plants at a variety of places for supplying the cars. The Pintsch gas has now been applied to over 85,000 cars.

PERSONAL.

Mr. C. P. Walker has been appointed purchasing agent of the Indiana & Illinois Southern, with office at Sullivan, Ind.

Mr. A. H. Crocker has been appointed superintendent of the Wisconsin & Michigan, with headquarters at Peshtigo, Wis.

Mr. W. E. McCarthy has been appointed master mechanic on the Carrabelle, Tallahassee & Georgia, with office at Lanark, Fla.

Mr. D. S. Hassett, general foreman of the San Antonio & Aransas Pass, has been appointed division master mechanic at San Antonio, Tex.

Mr. M. T. Carson, superintendent of machinery of the Mobile & Ohio, has removed his headquarters from Jackson, Tenn., to Mobile, Ala.

Mr. Chas. Ellicott, pit foreman on the Atchison, Topeka & Santa Fé Railway, has been promoted to roundhouse foreman at Las Vegas, N. M.

Mr. J. Campbell, master mechanic of the Lehigh Valley at Buffalo, has had his jurisdiction extended over the car department of that road at Buffalo.

Mr. W. Green has been appointed division master mechanic of the San Antonio & Aransas Pass at Yoakum, Tex., He was formerly general foreman.

Mr. C. F. Thiele has been appointed car inspector of the Pittsburgh, Cincinnati & St. Louis, with headquarters at Columbus, O., *vice* Mr. G. B. Harris, resigned.

Mr. James Harrington has been appointed superintendent of the Little Rock & Memphis, with office at Memphis, Tenn., *vice* Mr. A. G. Jones, resigned.

Mr. P. E. Garrison, division master mechanic of the West Shore at East Buffalo, N. Y., has been promoted to be assistant superintendent of motive power of the same road.

Mr. A. J. Menter, formerly master mechanic of the South Haven & Michigan at Lawton, Mich., has succeeded Mr. J. A. Long as master mechanic of the Oconee & Western at Dublin, Ga.

Mr. O. D. Ball, Jr., has been appointed general purchasing agent of the Seaboard Air Line, with headquarters at Portsmouth, Va. He takes the place of Mr. John Warwick, resigned.

Mr. William Renziehausen has been appointed master mechanic on the Atchison, Topeka and Santa Fé, with headquarters at Ft. Madison, Ia. He was formerly on the Pittsburg & Western.

Mr. W. W. Collins, superintendent of the Prairie du Chien division of the Chicago, Milwaukee & St. Paul, has been transferred to the same position on the Chicago division.

Mr. J. B. Cable, superintendent of the Chicago division of the Chicago, Milwaukee & St. Paul, has accepted the position of general manager of the Ohio Coal Company at St. Paul, Minn.

Mr. A. G. Jones, superintendent of the Little Rock & Memphis, has been appointed assistant superintendent of the Sixth division of the Southern Railway. Headquarters, Birmingham, Ala.

Mr. William Whyte, general superintendent of the Western division of the Canadian Pacific, has been appointed manager of the lines West of Fort William, headquarters at Winnipeg, Man.

The officials and employés of the Nashville, Chattanooga & St. Louis at Nashville, Tenn., presented Mr. J. W. Thomas, president of that company, with a life-size marble bust of himself, on May 12th.

Mr. A. L. Mohler, for the past three years general manager of the Minneapolis & St. Louis, at Minneapolis, Minn., has been appointed vice-president of the Oregon Railroad & Navigation Company.

Mr. Richard Marpole, formerly division superintendent of the Pacific division of the Canadian Pacific, has been promoted to the position of general superintendent with headquarters at Vancouver, B. C.

Mr. W. O. Sprigg, who recently resigned as superintendent of the Staten Island Rapid Transit Railroad, has been appointed assistant superintendent of the Third division of the Southern Railway.

Mr. C. L. Pierce, assistant general superintendent of the Central Vermont, has been appointed general superintendent of the Rutland Railroad, succeeding Jesse Burdett, deceased. Headquarters, Rutland, Vt.

Mr. W. H. Brimson, superintendent of the Brainerd & Northern Minnesota, has been appointed superintendent of the Ohio division of the Baltimore & Ohio Southwestern, with headquarters at Chillicothe, O.

Mr. A. A. Allen, assistant general manager, of the Missouri, Kansas & Texas, has been promoted to vice-president and general manager of that road. Headquarters, St. Louis, Mo. He succeeds Mr. T. C. Purdy, resigned.

Mr. E. X. Hastings has been appointed superintendent of the Prairie du Chien division of the Chicago, Milwaukee & St. Paul at Milwaukee. He was formerly superintendent of terminals of the same road at Milwaukee.

Mr. J. W. Duntley, president of the Chicago Pneumatic Tool Company, sailed for Europe last month. Owing to the extensive business that this company has built up in Europe, it is necessary for Mr. Duntley to take this trip.

Mr. O. P. Dunbar has been promoted to the position of superintendent of motive power of the Wheeling & Lake Erie; headquarters at Norwalk, O. He has been general master mechanic on the same road for fourteen years.

Mr. William J. Sharp, trainmaster of the Chicago division of the Baltimore & Ohio at Garrett, Ind., has been appointed superintendent of the Staten Island Rapid Transit road, to take the place of Mr. W. O. Sprigg, resigned.

Mr. J. D. Landis, who has been assistant purchasing agent of the Philadelphia & Reading for the past four years, has been appointed purchasing agent of that road, succeeding Mr. Albert Foster, deceased. Headquarters, Philadelphia, Pa.

Mr. Robert Patterson, general foreman of the locomotive shops of the Grand Trunk, at Port Huron, has been appointed master mechanic of the Western division of that road, with headquarters at Fort Gratiot, Mich., *vice* Mr. H. Roberts, resigned.

Mr. J. B. Braden has resigned his position of general foreman of the locomotive department, of the Pittsburgh, Cincinnati, Chicago & St. Louis shops, at Columbus, O., to become assistant superintendent of motive power of the Lake Erie & Western, at Norwalk, O.

We are glad to learn that the rumor regarding the appointment of Mr. John Hickey as general master mechanic of the Rio Grande Western Railway is true. He has charge of the machinery and rolling stock of that company, with office at Salt Lake City, Utah.

Mr. Thomas Tait, assistant general manager of the Canadian Pacific, has been promoted to the position of manager of the lines of that company East of Fort William—headquarters at Montreal—and the office of assistant general manager has been abolished.

Mr. J. F. Deems, recently appointed master mechanic of the St. Louis division of the Chicago, Burlington & Quincy, has been made master mechanic of the Iowa division of the same system, with headquarters at Burlington, Ia. He succeeds C. W. Eckerson, deceased.

Mr. J. A. Rasbeck, formerly trainmaster on the Denver, Leadville & Gunnison, has been appointed superintendent of the Cheyenne & Northern division of the Union Pacific, Denver & Gulf, with headquarters at Cheyenne, Wyo., *vice* Mr. T. H. Fitzpatrick, resigned on account of ill health.

Among the subscriptions received by "Locomotive Engineering" last month was one from Princess Marie Louise de Banffremeont, Paris, France. We have always considered that the paper was growing in popularity, but we were not before aware that royal princesses found it entertaining reading.

The office of chief dispatcher on the Rio Grande Western has been abolished and the duties assumed by the trainmaster.

Mr. Frank Selgrath has been appointed train supervisor, and will report to Mr. A. E. Welby, general superintendent. In matters pertaining to the machinery department he will report to the general master mechanic.

In talking to the New York Railroad Club, Mr. Chauncey M. Depew said that thirty years ago, when he was a young lawyer, he received two offers of employment, which he took into serious consideration. Secretary Stanton offered him the position of minister to Japan, with a salary of $8,000 a year, and Com. Vanderbilt offered him a position, with a salary of $2,000 a year, which, on due consideration, he preferred to the bigger salary. In the conversation with Mr. Vanderbilt about entering railroad service, the Commodore remarked that politics and poverty went together.

EQUIPMENT NOTES.

Bids for 100 box cars have been opened by the Philadelphia & Reading.

The Georgia Central Railroad are said to be in the market for 300 freight cars.

It is reported that the Moblie & Ohio Railroad are to bid on 400 freight cars.

The Pullman Car Company are building 500 cars for the Baltimore & Ohio.

The Chicago, Rock Island & Pacific Railway are building six freight engines.

The Canadian Railway are to build twenty-one engines at their Montreal shops.

The Brooks Locomotive Works are to build three side-tank locomotives for China.

The Boston & Maine are having ten passenger cars built at the Pullman Car Company.

The Wells & French Company are building 200 refrigerator cars for their own use.

The Baltimore & Ohio are having 100 freight cars built at the South Baltimore Car Works.

The Rogers Locomotive Works are to build fifteen locomotives for the Mobile & Ohio Railroad.

The Brooks Locomotive Works are building three engines for the Sung Wu Railway, of China.

The Southern Railway have ordered twelve locomotives from the Richmond Locomotive Works.

The Pittsburg Locomotive Works are building one engine for the Pittsburg & Lake Erie Railroad.

Japan has given an order for two locomotives to the Cooke Locomotive Works, Paterson, N. J.

The Waters & Pierce Oil Company are having fifty freight cars built by the St. Charles Car Company.

The Haskell & Barker Company are building four freight cars for the Spokane Falls & Northern Railroad.

The St. Charles Car Company are building twenty-five freight cars for the Mexican Central Railway.

The Union Railroad are having two consolidation engines built at the Pittsburg Locomotive Works.

The Sierra Railroad, of California, are having two passenger cars built at the Jackson & Sharp Company.

The Chicago, Milwaukee & St. Paul Railway are to build 200 special cars at the West Milwaukee shops.

One engine is being built at the Baldwin Locomotive Works, for the Oahu Railway & Land Company.

The Lima Northern Railway are having two fast passenger engines built at the Baldwin Locomotive Works.

The Pullman Car Company are building two passenger cars for the Kansas City, Pittsburgh & Gulf Railway.

The St. Louis, Peoria & Northern Railway are in the market for several hundred cars, both freight and passenger.

The Norfolk, Virginia Beach & Southern are having four passenger cars built by the Jackson & Sharp Company.

The Chicago, Rock Island & Pacific Railway have ordered fifty refrigerator cars from the Wells & French Company.

The Baldwin Locomotive Works are delivering the twelve engines recently built for the Chinese Government Railroads.

The Newfoundland, Northern & Western Railroad are having three passenger cars built by the Barney & Smith Company.

The Armour Packing Company are having built 350 cars, 300 of which are refrigerator cars, by the Wells & French Company.

A sample gondola car of 80,000 pounds capacity is being built by the Buffalo, Rochester & Pittsburg Railway at their own shops.

The Dickson Manufacturing Company, of Scranton, Pa., are to build a 12 x 18-inch switch engine for the Midvale Steel Company.

The Pullman Company are building a new vestibule train for the Burlington road, for their limited run to St. Paul and Minneapolis.

It is rumored that orders for engines from railroads in China and South America have been received by the Rogers Locomotive Works.

The Baltimore & Ohio Railroad are to have twenty consolidation engines and five 10-wheel passenger engines built by the Baldwin Locomotive Works.

The San Francisco & San Joaquin Valley Railway are having one combination passenger and baggage car and fifty stock cars built by the Pullman Company.

The Seaboard Air Line are to have two locomotives built by the Richmond Locomotive Works, very similar to the engines built for the same company by the Richmond and Pittsburgh Locomotive Works.

The Ohio Falls Car Manufacturing Company have furnished the Georgia & Alabama Railroad with two combination chair and sleeping cars, which are intended for service between Americus and Savannah.

The Mexico Cuernavaca & Pacific have ordered from the Brooks Locomotive Works one 10-wheel engine, 20 x 24. This engine will be similar in all respects to those built by the Brooks Locomotive Works for the Mexican Central.

On page 436, in the description of the Duluth & Iron Range shops, reference is made to illustrations which do not appear. The photographs which were sent in to make the illustrations from were so dim that we could not make proper reproduction; consequently, they were left out. Through a mistake, the references to the cuts were not taken out of the article.

Another Prearranged Collision.

The latest railroad company to engage in that idiotic feat of making two locomotives meet purposely in collision was the St. Louis, Kansas City & Colorado. The spectacle was witnessed at a place called Forsythe, near St. Louis.

This railroad company seemed to be more economical in their arrangements than other railroads, for the locomotives were divested of the pilots and of every article that could be taken off that was liable to get damaged in the collision. The speed reached was not sufficient to damage the engines to a great extent, and they are probably in service by this time, the cost of repairs having been defrayed by the money collected from the people admitted to see the show.

When the mild collision happened, the spectators howled with derision and made manifest the fact that they did not consider they got the worth of their money. The hissing of the escaping steam from the locomotives after they came together was said to be drowned by the hissing of the people, who did not witness the exciting show they expected.

The Southern Pacific general manager, Mr. Kruttschnitt, has directed that a very thorough system of tests should be made all over the system, to show what load locomotives of various classes are able to pull. The unit used for rating engine loads is 1,000 pounds and is spoken of as so many Ms.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Brake Cylinder Pressure Regulated by Brake-Shoe Friction.

Believing it will be of interest to many air-brake men to know what has been done regarding the regulation of brake cylinder pressure by the friction of the brake shoes against the wheels, we present the following illustration and description of a device invented by Mr. Geo. Westinghouse, and experimented with by Captain Galton on the Brighton Railway, England, in 1879. Captain Galton in his report says:

"In some of the former experiments on the Brighton Railway a pressure-reducing valve was introduced by Mr. Westinghouse, with the view of reducing the brake-block pressure as the speed was reduced, and excellent results were obtained. And it will be recollected that the author, in his last paper, pointed out the possibility of devising some self-acting apparatus whereby the friction between the blocks and wheels should actually regulate the pressure put upon the blocks, and keep it at the precise amount required.

"Mr. Westinghouse has since devised a new valve, so arranged in connection with one of the brake-blocks that the friction between the block and wheel regulates the pressure upon the blocks. The author had the opportunity of making some experiments on the Brighton Railway on 20th January, 1879, for the purpose of testing this new valve. These experiments are very interesting, as tending to elucidate this part of the subject. The valve, as then used for the first time, was found to regulate the pressure of the brake-blocks against the wheels, and to reduce the pressure as required, except at the last moment, when the escape port was incapable in some cases of discharging the air fast enough to prevent skidding for a very short distance. It was also found that there was a needless waste of air from the reservoir. From the experience gained, a slight alteration has been made, which obviates the above difficulties.

"The general arrangement of the regulating valve as applied to railway carriages is shown in Fig. 1; Figs. 2 and 3 are enlarged sections of the valve itself, the first in the normal condition when it is closed, and the second when it is opened to reduce the pressure. In order to understand the action of the valve, suppose that four blocks act against a pair of wheels, the load at *A* (Fig. 1) on the two wheels being 10,000 pounds. The lever *B* is of such a proportion that the block *C* has 3 pounds pressure upon it for every 2 pounds on the block *D*. If the coefficient of adhesion at *A* is .20, the total adhesion is equal to 2,000 pounds for the two wheels, or 1,000 pounds for each wheel. If the rotating momentum of the wheels be taken as equivalent to an increase of 1-10 of the weight at *A*, then the four brake-blocks will have to offer a resistance of 2,200 pounds to the two wheels, of 1,100 pounds to one wheel, in order to obtain a result equal to .20 of the load at *A*. If the friction of the blocks *C* and *D* on one wheel together equals 1,100 pounds, then, owing to the proportion of pressure upon them, the resistance offered by *C* will be 660 pounds and by *D* 440 pounds. The block *C* is suspended from one end of a lever *E*, the opposite end of which, acting through a link *L*, tends to move one or other arm of the double bell-crank lever *F*. The form of this lever *F* provides for the rotation of the wheel in either direction. The lever *E* has a proportion of 6¾ to 1, and consequently requires 97.7 pounds, at its long end, to equal 660 pounds, the assumed friction of the block *C*.

"The motion of the lever *F*, Figs. 2 and 3, Plate 20, is resisted by the bolt *G* and spring *H*. When, however, the force on the link *L* is sufficient to move the bolt *G* and compress the spring *H*, a plug valve *J* in a case *K* is moved by the bolt. This valve communicates with the triple valve and air-reservoir by the pipe *P*, and with the brake-cylinder by the pipe *M*; while *N N* are openings to the external air. When the regulating valve *J* is closed (Fig. 2) these openings are shut, and the passage from the reservoir to the brake-cylinder is open; but when the valve *J* is pushed inwards by the bolt *G*, it first closes the passage of air from the reservoir to the brake-cylinder, and then, if moved slightly further, it opens the passage from the brake-cylinder to the atmosphere, thereby reducing the pressure of the air in the brake-cylinder, according to the area of the passage and the time during which it is kept open. The spring *H* alone offers 75½ pounds resistance to compression, which is equivalent to a coefficient of adhesion of .15 between the wheel and the rail. The regulating valve *J* has slightly over .3 square inches area, and if acted upon by an air pressure from the reservoir of 75 pounds per square inch it gives an additional resistance of 22½ pounds, making a total resistance of 98 pounds, equivalent to a coefficient of adhesion of .20. If a pressure of only 37½ pounds per square inch be admitted to act upon the valve *J*, the total resistance against the lever *E* will be only 86.6 pounds, equivalent to a coefficient of adhesion of .175. Thus it will be seen that by simply regulating the air pressure in the reservoirs under the carriages, a considerable variation in the resistance can be made according to the state of the rails. One of these regulating valves is put on

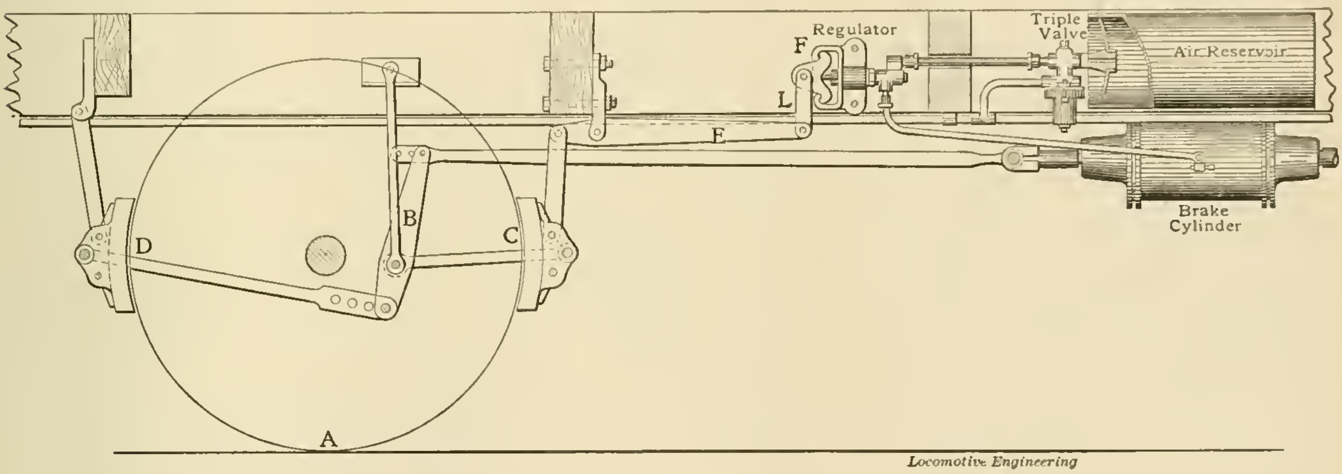


Fig. 1. AUTOMATIC PRESSURE REGULATOR.

each carriage, and the spring *H* and valve *J* are alike in all.

"The lever *E* must be proportioned according to the load at *A;* and with the arrangement of brake levers and blocks shown in Fig. 1, Plate 19, the long end will be to the short end as 1½ to 1 for a load of 1 ton on each pair of wheels, or as 7½ to 1 for a load of 5 tons. If the brake levers and blocks were not arranged as shown, the proportion of the lever would have to be altered, so that the actual amount of resistance on the short end should give 98 pounds pressure on the long end. It is essential in the use of this regulating valve, if one valve is to operate for the whole carriage, that the brake gear should be so arranged that any one block can act as a fulcrum for all the others. By this arrangement it becomes a simple matter so to regulate the brake pressure as to produce a definite maximum amount of brake resistance; the amount thus fixed should equal the highest average amount required.

"The regulating valve can thus be arranged so as to prevent the skidding of the wheels; and by the fact that it closes the passage for the air from the reservoir to the brake-cylinder before it allows any escape of air from that cylinder to the atmosphere, it possesses the property of permitting a high working pressure to be constantly maintained in the reservoir, without the danger of ever getting too high a pressure in the brake cylinder. At the same time, if, after the valve has been opened to the atmosphere, an increased pressure on the brake blocks is again required in order to compensate for the diminution of friction owing to lapse of time or to other causes, the decreasing friction will allow the valve to close the escape orifice from the brake-cylinder and reopen the connection to the air reservoir; it will thus replenish the cylinder with the original high pressure of air, which may be again reduced and again restored by the valve as may be required."

Latest Air-Brake Book.

Send in all correspondence as early in the month as possible.

The Chattanooga air-brake instruction car is probably the best designed and one of the best furnished cars of such nature built.

If you have any air-brake device you think would be of general interest to air-brake men, send a drawing or photograph of it to "Locomotive Engineering" for illustration.

Correspondents sending drawings or photographs for illustration cannot be too careful in selecting those which are clear cut and well detailed. Be crisp and concise in description.

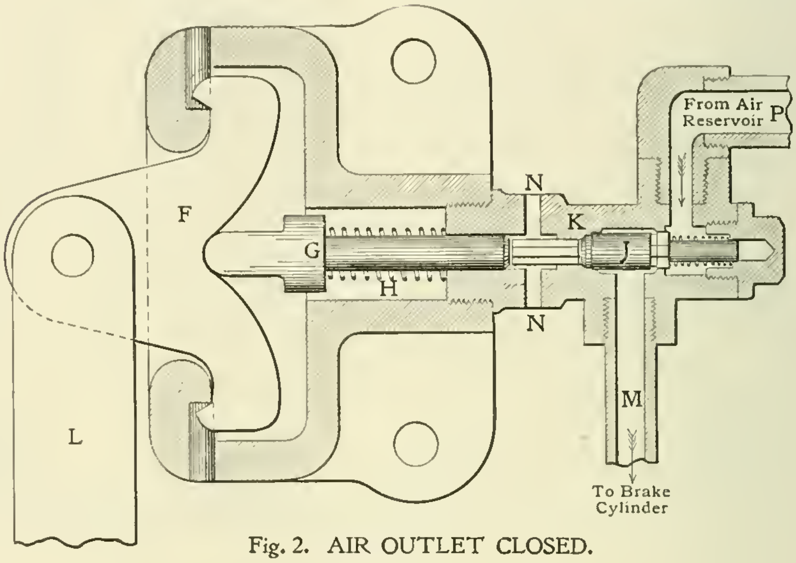


Fig. 2. AIR OUTLET CLOSED.

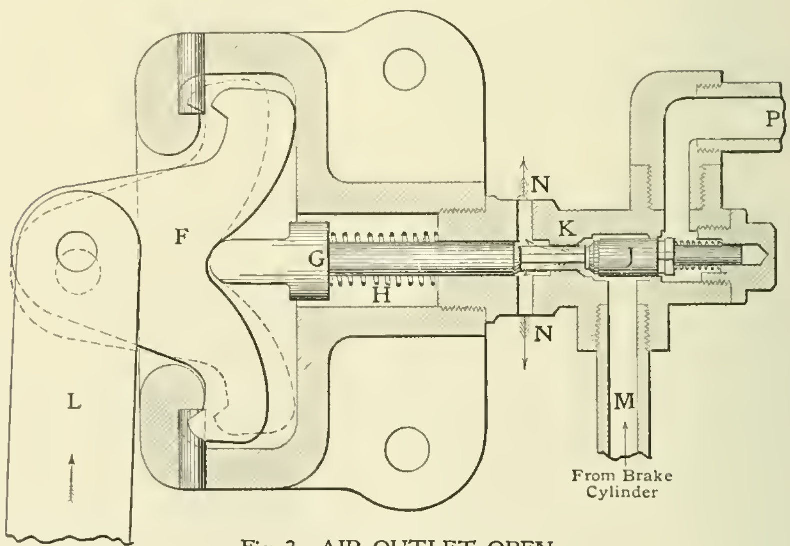


Fig. 3. AIR OUTLET OPEN.

AUTOMATIC PRESSURE REGULATOR.

The Dickson Locomotive Works have received an order for eight ten-wheel engines for the Atchison, Topeka & Santa Fé. They are intended for heavy fast passenger service, and have cylinders 19½ x 28 inches, driving wheels 73 inches diameter, boiler 60 inches diameter at smallest ring; carry 180 pounds working pressure.

CORRESPONDENCE.

Regarding Standards.

Editors:

I have read with great interest Mr. Desoe's criticism of my last article in your March number, in which I asked if it was good policy for railroads to adopt standards, the effect of which is to repress the inventive spirit of inventors. Certainly, if it is good policy in the case of brakes and couplers, it would be good in other appliances. The adoption of these standards in effect says that perfection has been reached.

Suppose that years ago, when wooden springs for trucks and bumpers were common, the claim had been set up that everything in that line (they were thought to be good enough in those days) should conform therewith, where would we be to-day? Have we now reached perfection in these lines? Is there no hope that in the future something better may be designed? Must we go on forever using only the present standard brake and standard coupler because the M. C. B. has set them up as standards? I believe them to be the best now in use. As to my judgment in this regard, I ought to have some knowledge on the subject, and I believe there are hundreds of railroad men who would confirm me in this belief.

Suppose I "have a preference for some other form of brake for personal reasons." Is it not possible that I may have some ideas worth looking at? Suppose I were to come to Mr. Desoe and claim that I had a plan for brakes that would require a great deal less volume and pressure of air to operate; one which needs no excess pressure, and which requires but one size cylinder for all cars; would work well in a train of other brakes, and perform other functions that the present system cannot perform. I believe he would say to me that he didn't want to look at anything or have anything to do with any plans outside the M. C. B. standards. If I undertook to reason with him, very likely he would tell me that I ought not to set up my judgment against numerous men who had studied the subject. That is the way others in similar positions talk, saying at the same time that, even if the M. C. B. Association had made a mistake, it is too late now to correct it.

I think Mr. Desoe's inference, drawn from the quotation he makes from my article, is rather strained. What I wanted to show was that, in spite of the opposition of locomotive builders like Norris, Baldwin, Mason and others who had plans of their own, the link, on its own meri s has driven all the other forms out of existence, and that, too, without being made the standard by any association.

BENJ W. SMITH.

Princeton, Ind.

[Our correspondent seems to lose sight of the fact that the adoption of standard forms for couplers and air brakes has been brought about by a body of practical, experienced men whose every day association with these devices in all classes of service renders them ably fit to legislate for their own needs. These standards have been adopted after the same careful consideration and experiment that relegated the wooden springs on trucks, and established the superiority of the link motion for locomotives as described in the above article. If our correspondent is the inventor of a form of air brakes which he believes is better than the present form, as he hints, and will send us drawings of it, we will publish it and give it every opportunity to do to the present standard form of brake what the steel spring did to the wooden, and what the link motion did to the other valve gears. —Eds.]

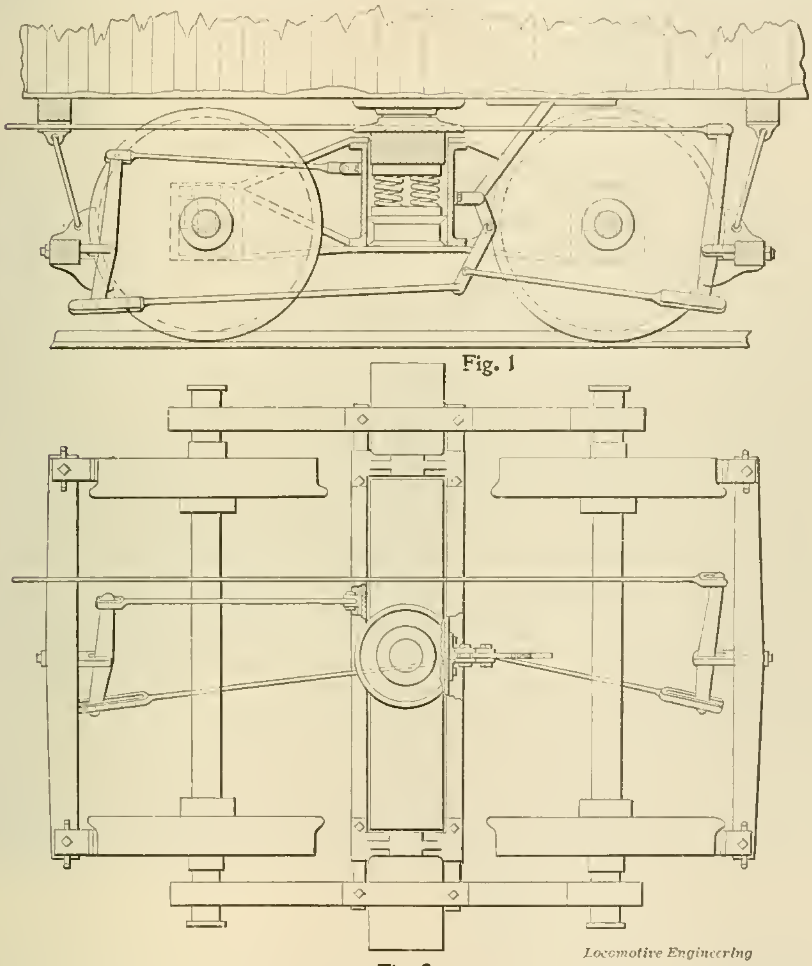


Fig. 1

Fig. 2

THE DOWNING AUTOMATIC SLACK ADJUSTER.

A Brake Slack Adjuster.

Editors:

The cuts of the adjuster which we send you herewith relate to our invention of utilizing the rise and fall of the car body to automatically adjust the slack in the brake connections.

It consists of a bottom rod of two parts which are connected to an equalizing lever which is operated upon to change the angle, and thus vary the length of the bottom rod by a bell crank lever which is pivoted to the truck frame and bears upon the bottom of the car body.

JAMES B. DOWNING,
H. E. DOWNING.

Arkansas City, Kan.

Don't Do It.

Editors:

In your March number appears an article by Mr. Smith in which he regards with disfavor the adoption of a standard air-brake system, and questions the wisdom of such a course.

He implies that it would be advantageous to railway companies to not adopt any standard, and thus keep the field open to all inventors who might choose to please and enrich themselves by experimenting at the railway company's expense. This would be advantageous to any Tom Dick and Harry who had an air brake to sell, or who wished to invent one, but the railways would suffer. The patient would be dead long before he had taken all the different doses prescribed by the numerous medicine men. It was with this very point in view that the Master Car Builders held the Burlington brake trials in 1887, and decided upon a standard brake system.

Mr. Smith's comparison of the link motion and the air brake is an inverse one. The locomotive builder mentioned who opposed the adoption of the link for locomotive service was on the wrong side, as it has since transpired. Advocates of two-pipe air-brake systems are also plainly on the wrong side, as the historic Burlington brake trials demonstrated.

The advantage of arranging so the rear brakeman can operate the air-brake, as Mr. Smith mentions, is a negative one. There is no surer way of breaking a train in two than to apply the brakes from the rear end. This is evidenced by the use of hand brakes next to the way car on a partially equipped air-brake train.

The single line system is good enough for us to handle until something better is developed. Then we want that. But inventors of double pipe systems have much hard work before them to convince railways that the increased advantages to be had from such system are greater in proportion to the cost of extra equipment and maintenance.

AMOS JUDD.

Boston, Mass.

The N. C. & St. L. Ry's New Air-Brake Instruction Car.

Editors:

The accompanying photographs illustrate our new Air-Brake Instruction Car recently finished at our Nashville shops.

Fig. 1 is an exterior view of the car, which is 60 feet in length, and is mounted on two 6-wheel trucks having a brake on each wheel, which receives its force from a 14-inch brake cylinder. The car weighs 100,000 pounds when in working order.

Fig. 2 is an interior view of the car, which shows the arrangement of the twenty sets of freight brakes. The upright plan was adopted, as it gives more room, better light and better ventilation. The full amount of piping for this number of cars is laid underneath the floor. Signal apparatus with proper amount of piping is arranged in the clere-story of the car. At the farther end, to the right, is the instructor's station, which is properly supplied with tandem triple valves, gages, and other instruction apparatus.

Fig. 3 is an anterior view showing the boiler, which is of Westinghouse manufacture, and has the pump supported to the boiler in the same manner as that of a locomotive. In this way we get rid of the disagreeable thump experienced by having the pump located and attached at the side of the car. The pan underneath the boiler is to receive the water when the boiler is being washed out. All drains empty into the ash-pan. An ash chute carries the ashes and dra'nage from the pan down underneath the car to the ground. This boiler is nicely jacketed with Russia iron held in place by brass bands. The piping is of copper, nicely bent and polished. As will be seen by the photograph, the boiler closely resembles that of a fire engine. Beyond the boiler, on the right, is the water tank which holds 400 gallons of water. On the opposite side is the coal bunker, which holds a supply of coal which will last for a week or ten days. This bunker counterbalances the weight of the water tank. As will be seen, this arrangement of boiler, water tank and coal bunker equally balances the material in that end of the car, and the weight is thrown directly to the center of the truck. To the right is the work bench. To the left is the folding-bed for the porter.

Fig. 4 is a view had of the boiler by entering the car at the machinery end. An idea of the careful workmanship put upon this boiler can be had from this photograph.

Fig. 5 is a view of the office end of the car. To the left is a folding bed which, when folded up as shown in the photograph and ornamented by the flower pots, looks considerably like a mantelpiece of a parlor. To the right is the wash basin and mirror. On the right wall are telltale gages connected to the train pipe, brake cylinder, auxiliary reservoir and signal pipe. The instructor's desk is also at the right and is conveniently designed.

Water is forced to the basins by compressed air. The car is fitted throughout with electric lights, which will be connected to the wires of the plants at the various stations at which the car stops. Linoleum covers the floor of the entire car.

Two years ago, when the subject of an air-brake instruction car for the N. C. & St. L. Ry. first came up, it was proposed to take an old coach or baggage-car and adapt it to this purpose. Assistant General Manager Thomas objected to the scheme. He believed that anything worth doing was worth doing well. He argued that the importance of air-brake instruction would be more strongly emphasized to the mind of a man upon entering a neatly fitted and well-designed car than would be the case if he were ushered into an antediluvian coach having a few pieces of air-brake apparatus hung on the walls.

Accordingly, we set to work to build a complete new air-brake instruction car that would be second to none in design, workmanship and utility. How well we have succeeded can be judged from the illustrations. Those members of the Air-Brake Association who visited the car during the recent Nashville Convention, where it was on exhibition, will be better able to appreciate the convenience and advantages of this car.

OTTO BEST,
Gen. A. B. Insp., N. C. & St. L. Ry.
Nashville, Tenn.

Fig. 1. N. C. & ST. L. RY. AIR-BRAKE INSTRUCTION CAR.

Field Notes.

Editors:

The check valve, which is part of a quick-action triple, and is expected to keep the air in the brake cylinder from getting into the train pipe when hose is burst or parted, or the pressure is lower in train pipe than in the brake cylinder, does not receive the attention that it should. This is because it has nothing to do in an ordinary service application, as long as the train pipe pressure is not reduced lower than the brake cylinder pressure. A leaky check valve will produce curious effects, of which we will give some sample cases.

A part air-brake freight train, consisting of engine, tender and two cars, with brakes all working, followed by enough non-air cars to make a full train, broke in two between the first and second cars, on account of the knuckle in the Master Car Builders' coupler becoming unlocked, and opening.

As soon as the cars separated far enough to pull the hose couplings apart, the brakes went on at once. The force of the rear end of the train closed up the gap, and couplers locked again. The head brakeman ran back over the car, and seeing the hose parted, and Master Car Builders' couplers together again, went down the end ladder, closed the angle cock on the head car, signaled the engineer to release brakes, which was done on engine, tender and first car (the brake on second car having already let off entirely). The train proceeded without further delay to the next stop, where the hose was coupled up between the two cars, the brake tested, found to work all right and hold good on a service application, just as it did every time the engineer set it on the trip of 150 miles.

Why did the brake on the second car not hold when the train broke in two? Because, as soon as the hose coupling separated, all the air in the main pipe escaped at once; the train-pipe check No. 15 in this second triple leaked the air out of the brake cylinder and auxiliary into the open train pipe and outdoors. When charged to full pressure, and tested with a service application, the train-pipe pressure was not reduced below 50 pounds; so air could not pass from the brake cylinder to the train pipe.

Moral—Don't let all the air out of the train pipe if you want the brakes to hold with a service application. There may be a leaky check valve in some triple.

Here is another: In company with some air-brake experts, a visit was paid by the writer to a test of some newly invented triple valves. A fifty-car rack was used, and the brakes were operated with a D-5 valve. The triples were not Westinghouse. A very heavy service reduction was made from 70 pounds down to 40 pounds in the train pipe. When the handle of the valve was lapped, the equalizing

Fig. 2. N. C. & ST. L. RY. AIR-BRAKE CAR.

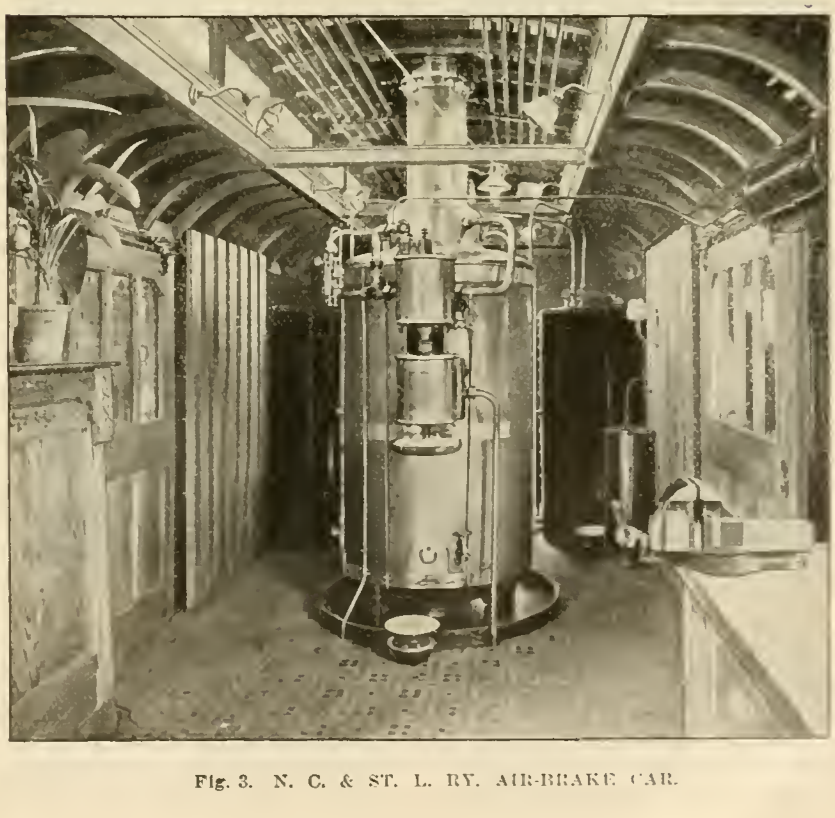


Fig. 3. N. C. & ST. L. RY. AIR-BRAKE CAR.

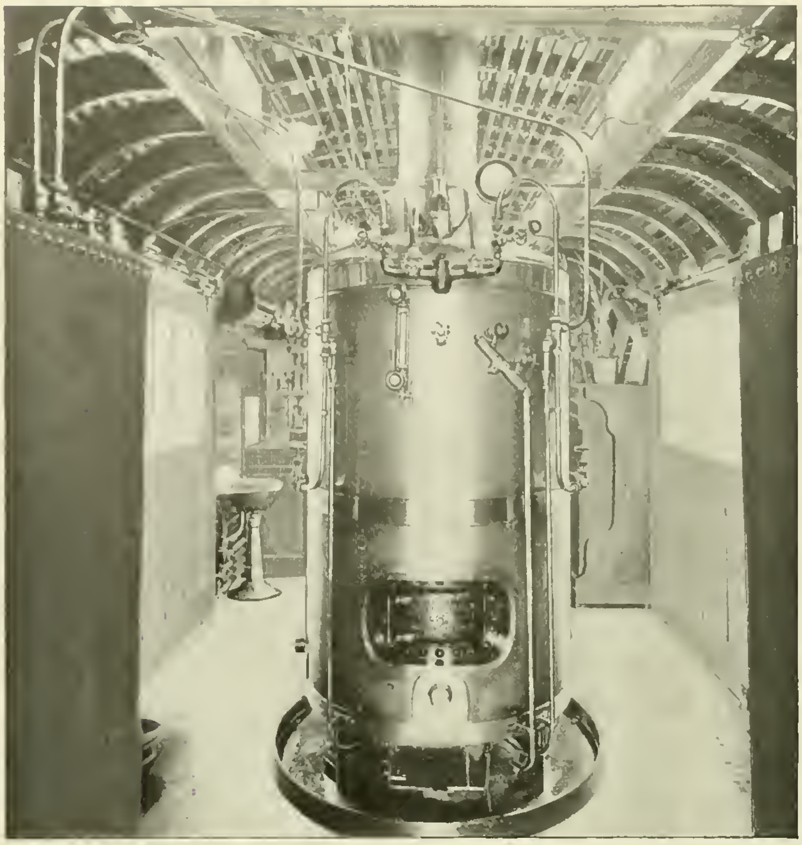


Fig. 4. N. C. & ST. L. RY. AIR-BRAKE CAR.

Fig. 5. N. C. & ST. L. RY. AIR-BRAKE CAR.

piston 47 did not seat as it should; it remained up, wide open. The man in charge used a hammer to jar it down, but it took its own time to seat. On the next test, which was a break-in-two, eight of the fifty brakes leaked off entirely, almost instantly, which proved that leaky checks were responsible for the curious action of the D-5 equalizing piston. When the pressure above the piston 47 was reduced to 40 pounds, the air in these eight brake cylinders and their auxiliaries leaked out of a 50-pound auxiliary reservoir and brake cylinder pressure into a 40-pound train pipe, and held the equalizing piston up till it was 40 pounds all around, when it seated itself.

Moral—Don't use a hammer on a brake valve to shake it into submission. It won't seat till pressures are lower below it than above.

While we are talking about a stuck piston, here is another one:

Couple up the two engines on a double-header air-brake train, let both engineers pump up the train. When ready to test, have the head engineer test the brakes, without being sure that cut-out cock under brake valve on second engine is closed, and the result will be that after you have made a moderate service reduction of 5 to 7 pounds, the equalizing piston will stay up as long as cut-out cock on second engine is open also, and main reservoir and air pump can hold the train-pipe pressure higher than chamber D pressure in valve that is discharging air, just so long as the piston will stay up.

Moral—Don't put all the blame on a stuck piston; sometimes it stays up because it has to, to show the other fellow's mistake.

CLINTON B. CONGER.
Grand Rapids, Mich.

Willett's Duplex Air Brake.

Editors:

The following is a description of my Duplex Air brake system which, with the accompanying drawings will make its understanding clear.

In initial charging, the engineer's valve is turned so that port *E* is brought into connection with chamber *K*; the valve *J* being raised from its seat by a spring *I*, allows the main reservoir pressure to pass through chamber *F* direct into the train pipe *A*, pushing piston *C-D*, of the duplex valve into position shown, rushing through port *H* past valve *G* to port *I* and pipe *F* into the auxiliary reservoir; also to the opposite side of the piston *C-D*, through crossover port *I* into the cylinders of the duplex valves and on slide valve *E*, creating a balanced pressure on both sides of piston *C-D*.

Now, in order to make a brake application, the engineer's valve is turned to connect tapering port *U* with port *P* and *N*; this allows a reduction to flow from chamber *A* of the duplex valve and train pipe *A*, through chamber *F* past valve *J*, chamber *K*, port *E*, port *U*, port *P*, port *N* and *L* into the compound and reducing pipe *B*, and through the pipe *T*, port *Y* and chamber *X* of the automatic cut-off valve into all the brake cylinders on the train, and equalizing in the same.

Also, as the reduction is made from chamber *A* of the duplex valve, and train pipe *A*, the auxiliary pressure now being greater on the opposite side of piston *C-D* of the duplex valve, pushes the piston

C-D, compressing spring B, until slide valve *E* uncovers port *K*; then a reduction nearly equal to that of the train line will also flow from the auxiliary reservoir to the brake cylinder, combining with the reduction from the train line in applying the brakes, also equalizing through the automatic cut-off valve and the compound and reducing pipe *B* with the brake cylinder the entire length of the train, giving an equal application, an equal release, and an equal pressure against all brake cylinder pistons, regardless of the travel of said piston. This should prevent 90 per cent. of the flat wheels now received.

When for any cause too great a pressure has been applied to the brake cylinder, and the train is being brought to a stop too quickly, and it is necessary to prevent this too rapid stopping of the train, by placing this valve in the position marked "reducing," the compound and reducing pipe *B* is connected to the atmosphere through port *S*, port *R* and *T*; in this position the brake cylinder pressure can be released to any desired amount from one pound to a full release, allowing the train to assume any desired momentum sufficient to carry it to the desired stopping point. The stop being made, the engineer's valve is placed in the full release position and remains there until another application is needed.

Here valve *H* comes into action. After brakes have been applied and train-pipe pressure reduced below the pressure of spring *I*, valve *H* moves upward, raising valve *J*; when engineer's valve is moved into release position, main reservoir pressure flows direct into the train line and at the same time through port *G* on to the upper side of diaphragm of valve *H*; when train-pipe pressure on the upper side of diaphragm *H* becomes greater than the spring pressure on its under side, valve *J* will close. Should the train line leak, the valve *H* will automatically open and keep the pressure constant in the train line after the valve *J* is closed; the pump being governed by main reservoir, pressure gains the excess pressure required for releasing brakes and recharging the train.

By the construction of the duplex valve the auxiliary reservoir can be charged almost instantly.

I can also with this system charge the auxiliary reservoir without releasing the brakes by closing the cock G^a on pipe *l*. This becomes of great assistance on mountain grades. The exhaust port through duplex valve is closed, and when air is charged into the train line it moves the slide valve *E* to released position and charges the auxiliary reservoir without releasing the brakes; at the same time, if a partial or full release is wanted, it can be had by placing the engineer's valve in position marked "reducing position."

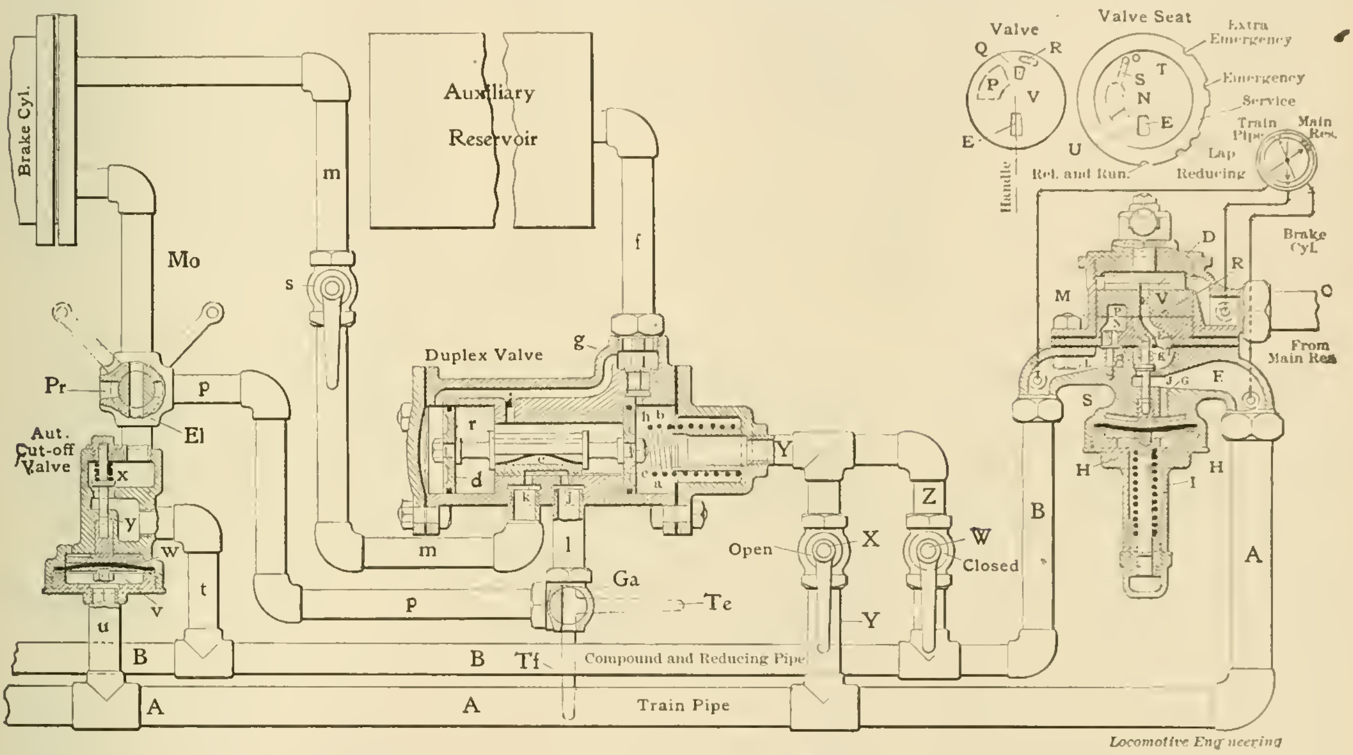
The compound and reducing pipe *B* is also connected to the air gage, which shows brake cylinder pressure in addition to main reservoir and train-pipe pressure; and when the brakes are applied the engineer can see the amount of brake cylinder pressure received, also the amount he releases from the brake cylinder. This practically gives the engineer full control of the application and release of brakes.

By this construction also I can, in an extreme emergency, equalize main reservoir pressure in the brake cylinders in addition to train-line and auxiliary reservoir pressure, by moving the engineer's valve to extra emergency position, connecting in that position chamber *D*, port *Q* with port *N* and the compound and reducing pipe *B* and the brake cylinder.

To provide for a wave of air, the piston valve *M* is normally seated in port *N*. When a reduction is made in the train line it passes through port *N*, pushes valve *M* from its seat and enters pipe *B*. Should it be a partial emergency application, which is always accompanied with a wave of air, valve *M* will prevent the wave from passing back to the train pipe and releasing brake.

Should the duplex valve become defective in my construction, I can cut it out by closing the cock *X* on pipe *Y* and cock *S* on pipe *M*, leaving the auxiliary reservoir and duplex valve of that car dead, and when the brakes are applied on the other cars, the pressure equalizing through pipe *B* applies the brake equally on the car thus cut out, also giving an equal release. Should the train part at any time when it is charged with air, the brakes will go to work automatically; the engineer's valve then should be placed in the lap position to retain main reservoir pressure to release the brakes. Under these conditions the automatic cut-off valve will close connections between the brake cylinder and pipe *B*.

Should the train line become broken under the existing conditions of air-brake practice, it is necessary to finish the trip with hand brakes; not so, however, with this system. In this case the engineer's valve is turned to position marked "extra emergency," which connects chamber *D*



THE WILLETT DUPLEX AIR BRAKE.

with port Q, port N with port L and the compound and reducing pipe B, and by closing cock X on pipe Y and opening cock W on pipe Z, connect the compound and reducing pipe B with chamber A of the duplex valve and charge the train on the second automatic system.

To apply the brakes in this case, the engineer's valve is turned to position marked "reducing position"; this allows a reduction to flow from the compound and reducing pipe B, which is in connection with chamber A of the duplex valve, through port S, port R and port T to the atmosphere. Applying the brakes the same as hereinbefore mentioned, to release the brakes, the engineer's valve is again turned to position marked "extra emergency"; this allows the main reservoir pressure to again charge the train, as above mentioned, through the pipe B. Should the train part, the brakes will go to work automatically the same as with the first automatic system. In this case the engineer's valve should be placed in position marked "lap," to retain main reservoir pressure, to release the brakes and charge the train.

For a service application there is a tapering groove U which bridge port P gradually laps as the valve is turned to service position, allowing the reduction to be made slowly or quickly as desired.

In running double head, the engineer's valve is simply placed in position marked "lap" on the engine not controlling the brakes. Should the engineers controlling the brakes call for brakes, all that is necessary is to move the engineer's valve, cut out to the service or emergency position, as the case may require; also, a partial or full release can be made if desired. The same can be done in the second automatic system running double head, with the exception of a partial release.

Should straight air be wanted on a train or shifting engine, by running engineer's valve in lap position, and turning the cock S on pipe M, the brakes can be operated on the direct system, applying and releasing the brakes at the engineer's valve.

By the construction of this system, I gain a high-speed brake and a speed release, the brakes can be applied in accordance with the requirements of the case, and released as desired through the reducing port of the engineer's valve.

A. M. Willetts,
Engineer, W. J. & S. R. R.
Camden, N. J.

[On account of the handling without gloves which the air-brake editor has recently received from some inventors, especially from certain of those having quick release and quick recharging triples and double train-pipe systems (not the above described system), our readers are hereby invited to write us their friendly criticisms on Mr. Willett's system of brakes, which, with our own comments thereon, will be published in our next number.—Eds.]

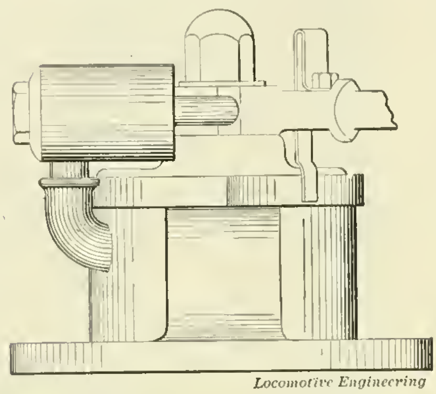
Briggs Attachment.

Editors:

I inclose you herewith a blueprint of my arrangement for returning the engineer's valve handle to running position from full release.

The device consists simply of a cylinder and piston stem. The dimensions of the cylinder are as follows: Outside length, 2⅛ inches; outside diameter, 1 7-16 inches; inside length of cylinder, 1 9-16 inches; inside diameter, 1⅛ inches.

The cylinder is so placed as to be at right angles with engineer's valve handle when in full release, and it receives



BRIGGS ATTACHMENT FOR ENGINEER'S BRAKE VALVE.

main reservoir pressure through a connection tapped in through side of brake valve with ⅜-inch pipe tap, as shown by the elbow below the cylinder.

Piston stem travels 1 inch; therefore the outside of the cylinder clears the engineer's valve handle, when in running position, 1⅛ inches. The piston is just wide enough to take two 1-16-inch packing rings, and has ½-inch stem. After returning the valve handle to running position, the piston makes a seat against the cylinder head and prevents any leakage.

This device has been in service on three of our engines for more than a year, and has given excellent results.

R. H. Briggs, Jr.,
K. C., M. & B. R. R.
Memphis, Tenn.

"Putting the Way-Car Ahead"—or, "Passengers, Change Seats."

Editors:

To one in the position of superintendent of air brakes or travelling engineer, it must seem remarkable, when they speak to an engineer for rough-handling of the brakes, to be told that they are the only ones who have ever found fault with his braking.

The smooth-handling of air brakes on all classes of trains is so general, that an engineer must feel deeply chagrined when he overhears some remarks that he is in the habit of "stopping the way-car first," "putting the way-car up ahead," or "loading all the freight in the head cars." On passengers trains the wording is changed to "passengers, change seats."

In starting, and especially stopping, it does frequently happen that jars occur at the rear of long trains, that are as unknown to the engineer as they are familiar to the rear brakeman and conductor, who say nothing to the engineer as long as they can keep the ash-pan in the way-car stove, or manage to keep their heads from being bumped against the sides of the windows when they "hear the slack coming."

While there are many trainmen who allow no favorable opportunity to pass to criticise, in the latest approved style, the work of the head-end, many engineers who do not hold the pessimistic idea that the trainman is their deadliest enemy, will, I think, agree with me that there is a feeling of dislike on their part to call the attention of the engineer to any irregularity in the handling of the train.

There are many engineers, who, in a pinch, slightly transgress some rule of air-braking, which they know to be a good one, in order to save time or inconvenience (the engine being opposite the water-spout or in just the right position to oil), and when they hear no unfavorable comments, continue to repeat the same operation frequently.

In handling passenger trains, there are but two ways to jerk a train badly with the air brake, either of which gain but little sympathy for the man detected in indulging in the forbidden practice. These are, holding the brakes on hard until the train comes to a dead stop, or using the emergency when the train is moving slowly. In either case on a passenger train is seldom or ever any jerk felt on the engine.

On freight trains there are so many ways to jerk the "hind end," unbeknown to the engineer, that I will cite but one that recently came to my notice, and which resulted in the train crew being reprimanded.

A superintendent riding on the way-car of a long freight train, usually composed of forty to fifty cars, with seldom over one-half air-braked, was warned by the conductor, as a certain stop was being made, that he had better get off just before they stopped, as the engineer was wont to stir things up pretty generally at that point. The superintendent's observation of that stop was sufficient for him to call my attention to the matter. I found that from instructions he had but a car length or two variation in his stopping place at this point, which was the terminus of his run, and that it was a hard pull into the siding for fully half the distance, when the grade pitched down to his stopping point. Those acquainted with the stopping of a train where the rear end lies "over the hill" can imagine all the rest when I say that he took his slack "in the usual manner," and had never been told of the results before I did so.

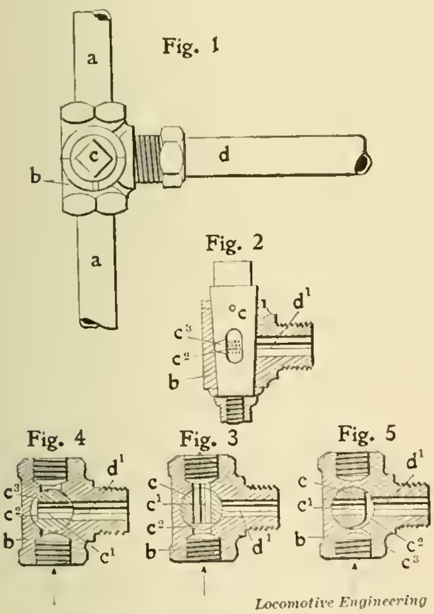
Moral: Tell the train crew, whether it be freight or passenger, and in such a way that they will think you mean it, that you would like to know of any irregularities occurring on a train which you, as engineer, are handling, and don't forget that sliding wheels on passenger trains is one of the items under the head of "irregularities."

E. W. PRATT,
Gen. A. B. Insp., C. & N. W. Ry.
Chicago, Ill.

Improved Attachment for Air-Signaling Apparatus.

This invention relates chiefly to the class of valves used in connection with air signals as now commonly used in railway trains, and our purpose is to provide a form of valve of cheap construction that may be quickly and effectually cleaned whenever the valve-way becomes clogged by dust or other foreign matter.

Heretofore it has been the common practice to place a disk of perforated material in one end of the valve-shell, which disk has to be removed whenever it is desired to clean the valve; but our present improved form of valve makes it possible to effect the cleaning almost instantly and without disconnecting any of the parts of the complete device.



SELF-CLEANING DEVICE FOR SIGNAL PIPE STRAINER.

As shown by the accompanying drawings, the side of the plug from which the air enters is slightly flattened or countersunk, as at *c* 2, and a piece of perforated metal or screen is secured within said countersunk portion, as best seen in Fig. 2. This screen serves to check all dust and other foreign matter that may seek to pass through the valve, and holds it until such time as the accumulation of dirt makes it necessary to clean the valve, which may be readily done by rotating the plug into the position shown in Fig. 5, when the said screen is brought into coincidence with the pipe *d*.

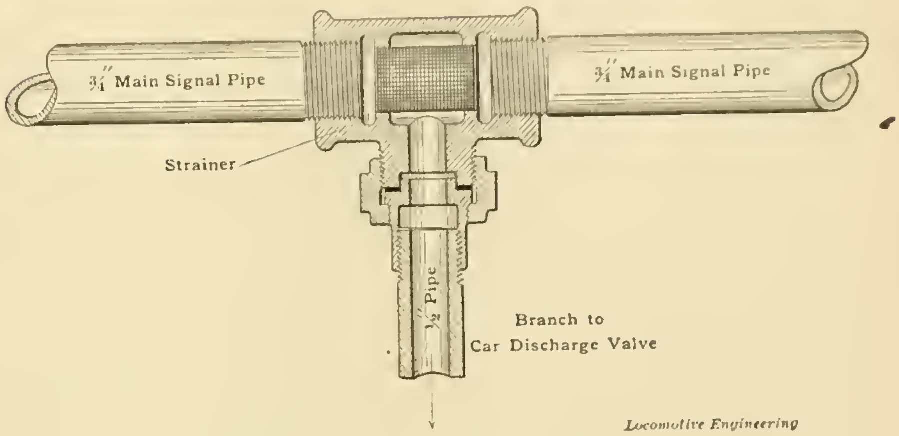
The plug *c* is cut away slightly, as at *c* 3, so that when the plug is rotated into the proper position for cleaning the valve, an open way is provided through which the current of air may force its way and dislodge the accumulation of dirt on the outer face of the screen. After the valve has been thus cleaned, the plug may be rotated back into proper position, either to shut off the flow of air entirely, as in Fig. 4, or to allow said air to flow through the main pipe *a*, as in Fig. 3.

The pipe *d* is provided simply to conduct the dirt or other foreign matter to any desired point outside of the car.

We find in practice that the cleaning of the valve is effected almost instantly, so that practically no time is lost in the cleaning operation, whereas heretofore it has been necessary to disconnect certain of the parts in order to reach the screen and remove it for cleaning. The device adds very little to the cost of this class of valves, and the arrangement of its parts is so simple that anyone of average intelligence can operate the same without special instruction.

WILLIAM D. REYNOLDS.
EDWARD SHANLEY.
Norwich, Conn.

[In car discharge valves of recent manufacture the screen is omitted, and dirt is arrested by the strainer tee as shown in accompanying cut.—Ed.]



THE WESTINGHOUSE STRAINER TEE.

Air-Pump Exhaust Attachment.

Editors:

For your information please find memorandum of test run here in month of December, 1896, which illustrates the point of economy in removing air-pump exhaust from the stack and placing it to important use. This attachment has proven a wonderful saver in coal, oil, wear of cylinders, machinery and boiler work, and worthy of consideration.

While a cut of the circulating exhaust attachment appeared in your August, 1896, number, I enclose you blueprint together with profile of division for ready reference:

Engine.	Miles.	Gallup Coal Tons Used.	Miles to Ton	Average
114	4,590	208	22.1	22.5
119	4,760	207	22.9	
123-C.E.A.	4,590	179	25.6	25.6

Saving in coal—$135 in favor of Engine 123.
Valve oil mileage—47% increase in favor of Engine 123.
Miles per pint—215.8.

Note—Engine 123 equipped with circulating exhaust attachment. Three engines run in "pool" on heavy passenger run, sixth district (Needles to Barstow, 170 miles). Engines 114 and 119 put in shape for test—Engine 123 six months out of shop and no alterations made—flues in service seventeen months.

With light coal and alkali water (heavily impregnated with mineral substances) we use, this is a remarkably good showing all round.

With this, while device not generally adopted on A. & P. and Santa Fe (from reason, proposition presented by them not satisfactory to me), ten roads have experimented with it; one accepted. The Mexican Northern, I understand, have equipped all their engines, taking cut and information from "Locomotive Engineering."

Some of the manufacturers have also taken kindly to attachment. As yet I have not had objectionable feature raised by any road having experimented with it.

W. S. HANCOCK,
M. M., A. & P. Ry.
Needles, Cal.

[The invention of Mr. Hancock referred to was illustrated in our August number last year, and will be familiar to our readers. The exhaust is led into the main exhaust pipe of the engine and has an automatic valve, which opens with the suction of the pistons when engine is running without steam, and breaks the vacuum otherwise formed by the pump action of the pistons.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(79) J. P., Toronto, Can., writes:

I am running an engine equipped with a driver brake having one auxiliary, one triple valve and two brake cylinders, one on each side. Now, if one brake cylinder piston had four inches travel and the other has six inches travel, would the brake on one side set tighter than the other, or would they both set equal? A.—The pressure in both brake cylinders would be the same, for the reason that both cylinders are in communication with each other by the pipe which unites them. This will be better understood when we remember that chamber *D* in the equalizing discharge valve is coupled by a pipe to the equalizing reservoir, and the pressures in both are the same. It would be preferable, however, to adjust the piston travel on both cylinders so that they would travel alike.

(80) G. L. B., Chicago, Ill., writes:

Is it possible for a single pair of wheels to be slid flat under one coach of a passenger train and not under the others? Say, for instance, the pair of slid flat wheels is under the middle car of the train. If wheels be so slid flat, and the standard train-line pressure of 70 pounds be carried, should the fault be placed on the unskilled application of the engineer or neglect of the car repairer? A.—It is seldom that all the wheels under a car are slid flat at the same time. A little more brake power on one pair of wheels, difference in the metal of brake shoes, wheels being out of round, and other controlling conditions make it possible to slide one pair of wheels when the others are not slid. With the meagre data given we could not presume to attach the blame at this long range upon anyone.

(81) A. B. C., Montreal, Can., writes:

On page 46 of the W. A. B. Co.'s Instruction Book, 1890 issue, an example of the Hodge and Stevens systems of levers are shown. Will you please explain what is meant by total brake beam leverage, which is given as 8 for the Hodge and 16 for the Stevens? A.—The proportion of a leverage is calculated from the amount of pressure it will give when certain other pressure is applied to give that force. If a thousand pounds be applied to the top end of a truck lever whose measurements are 21 and 7, the pressure delivered to the brake shoe will be 4,000 pounds, and the proportion of the lever will be 4 to 1. As there are four brake beam levers under a car, the total brake beam leverage would be 16. On the Hodge system one-half of this would go to the hand brake, which would reduce the total brake beam leverage to 8. As the Stevens system has no Hodge lever, the entire amount of brake force is used and the total brake beam leverage would be 16. See reply to "E. G." in question 50, March number.

(82) C. A. C., Hempstead, L. I., writes:

In December, 1896, issue of "Locomotive Engineering," I note where Mr. Schaffner states that while looking over his train he found one car with the triple cut out. He found the auxiliary reservoir empty. When he opened the cut-cock he claimed the brakes went on in the emergency. In explaining, he says that one-half of the emergency valve gasket was gone, which allowed full train-pipe pressure to go direct to the cylinder. Inasmuch that the piston 4 in the triple is in release position under the above-described circumstances, and the brake cylinder is connected to the atmosphere through the exhaust port in the slide valve, would not the train-pipe pressure pass through the cylinder and to the atmosphere without giving this application? A.—The opening made from the train pipe to the brake cylinder by the absence of half of the rubber seat of the emergency valve was, no doubt, greater than the opening from the brake cylinder through the exhaust ports to the atmosphere. There are men who have had a similar experience to that of Mr. Schaffner. Although the exhaust port is open, it seems that the admission of air to the brake cylinder is so much greater than the exit, that the brake will set, although there is a strong escape of air at the exhaust port.

(83) B. J. Smith, Princeton, Ind., writes:

I heard an expert air-brake man claim that a 6-inch Westinghouse air pump could pump up pressure to 1,000 pounds per square inch if it had sufficient steam pressure. 1. Is it not a fact that if we take a cylinder 12 inches long, with a loaded outlet valve at one end and a tight piston in the other end, if we push that piston to one-half its stroke, do we not obtain two atmospheres compressed therein? A.—Yes. 2. If pushed three-quarters of the stroke do we not have four atmospheres, and so on to the end of the stroke? A.—Yes. 3. If the discharge valve is blocked, may not the piston travel its full stroke and not force any pressure out? A.—Yes. 4. Does not the amount of pressure when reached depend upon the amount of clearance between the piston and the cylinder head? A.—Yes. If the steam and air cylinders of the air pump were able to withstand the severe effects of such high pressure without bursting, it is scarcely possible that 1,000 pounds could be delivered by the air-brake pump, as it is now constructed, as the clearance at the end of the stroke is too great for that pressure. Taking into consideration the clearance, the leakage past the packing rings, and the heating due to compression, the cylinder full of atmospheric air would occupy less than ⅛ of an inch in the end of the cylinder at 1,000 pounds pressure.

(84) J. R., Jersey City, writes:

I had a train of two baggage cars, four coaches and five parlor cars, eleven in all. Engine was equipped with D-5 brake valve. At the terminal the brakes were tested before leaving and found to be in good shape. The first stop was several miles out. I pulled away from there and everything went all right. A mile or two further on the train began to pull so hard that I stopped, and the brakeman bled off the brake on one of the parlor cars which had crept on. I had not gone more than two or three miles when the brake on a passenger car crept on. I stopped again and had the fireman bleed off the brake, and after that the brakes worked all right. My regular train consists of five cars, and when I get any more the brakes creep on. What is the cause of the trouble? A.—When releasing brakes you have probably allowed the handle of the brake valve to remain a little too long in the full release position, and the train line and auxiliary reservoirs have received a higher pressure than they should, and higher than would be allowed by the feed-valve attachment; consequently, the train-line pressure and auxiliary reservoir pressure had to leak down below the tension of the spring in the feed-valve attachment before any communication between the main reservoir and the train-line could be re-established. This leakage doubtless applied the more sensitive brakes. When releasing brakes leave the valve handle in full release but a few seconds, then return to running position, and your trouble will probably disappear.

(85) J. W. C., Waco, Tex., asks:

Why would not the old-style Westinghouse quick-action triple valve, which vents train-pipe pressure to the atmosphere in an emergency application, be an advantage over the present quick-action triple valve, which vents train-pipe pressure to the brake cylinder, as we would then get 60 pounds in the brake cylinder in both service and emergency applications? A.—Instead of being an advantage, the scheme proposed would be a detrimental one, for the reason that 50 pounds pressure to the square inch with the proper leverage is sufficient for all service applications of the brake, and is as high as can be used in service applications without danger of sliding wheels. In emergency applications, however, the full 60 pounds pressure is needed, and chances can be taken on wheels skidding. In earlier days when it was attempted to brake cars at 90 per cent. with the plain triple, (which was equivalent to the old quick action form venting to the atmosphere) a great deal of trouble was had with slid flat wheels, and we would have the same trouble were we to attempt to use the emergency pressure for ordinary service stops. An ideal triple is one that can be operated at will to give a moderate and sufficient pressure in service applications, or a sudden and higher pressure in emergencies that will stop the train in the shortest possible distance. It must be borne in mind that pressure alone does not give the braking power. A low pressure with a high leverage will produce as high braking power as a high pressure with low leverage.

Backing Trains Into Stations.

In your reply to Question 77, May number, "F. E. M." is advised that the brake valve should be lapped when brakes are being operated by the train men from the rear of passenger trains being backed into a depot.

This advised practice, I believe, is dangerous. With a brake valve in good order and the handle on lap, any train pipe leakage which can be compensated for by equalization through the feed-port in the triple valve will reduce auxiliary pressure instead of applying the brakes. Any particularly sensitive triple manifesting a tendency to call attention to the trend of affairs will be prevented from so doing by the leakage groove, and, where the interval between the lapping of the valve and the time for stopping is sufficient, auxiliary reservoir pressure will be so low that any credit for the stop will be due to an emergency application of the bumping post.

E. H. DeGroot, Jr.
Downer's Grove, Ill.

[In backing into a station, the distance covered is usually but a few hundred feet, and if a train were to run at a sufficiently slow speed to permit the auxiliary reservoir pressure to escape through the triple valve feed groove to the train pipe, and thence through leaks in the train pipe to the atmosphere, as noted by our correspondent, a close watch would be necessary to see the train move. Surely there would be little danger in this, and little work left for the bumping post to perform. However, should a train be backed up through a city or town where numerous applications were necessary for crossings at grade, etc., and it was the practice to have the train men operate the brakes from a "back-up hose," it would perhaps be the choice of some men to carry the engineer brake valve on running position. But it should be borne in mind that where two men on opposite ends of the train jointly manipulate the brakes, there always exists that condition where "too many cooks spoil the broth."—Eds.]

Pressure Recorders.

Air-brake men complain that there is as yet no pressure recorder in the market suitably adapted to air-brake work. The chief complaint made is that the machine moves the paper too slowly to register quick successive reductions. Two or three reductions can be made at short intervals, and the recording pencil will travel the same line each time. The machine will record a reduction in pressure, but will not give the number of reductions unless they are made a minute or so apart. This shortcoming robs the pressure recorder of all the value it might otherwise contain for air-brake work. What air-brake men want is a machine that will register those quick successive reductions which produce the greater part of the trouble experienced with air-brake operation. The ordinary fluctuation of pressure in a train pipe is comparatively of little moment. Pressure recorders are too expensive machines to employ merely to detect the carrying of a too high or fluctuating pressure. An ordinary gage will do that.

The pressure recorder offered to air-brake men is a machine specially designed to record fluctuations of pressure on steam boilers and gives an average travel of one inch per hour. This speed is sufficiently rapid for the work the machine was designed to perform, but it will not suffice for air-brake work. It would seem that the clock mechanism of the machine could be speeded up to suit air-brake men; yet one dealer has declared it to be an impossible task.

Good Yard Air Piping.

One of the best-equipped yards, in point of thoroughness and convenience, for testing the air appliances of cars, is that of the St. Louis & San Francisco Railway, at Springfield, Mo. The piping consists wholly of old 4-inch water mains that were abandoned by the company's water service people, who for some reason had no further use for it.

The best-arranged plans of an expert could hardly have produced a state of affairs more to the liking of Mr. Groves, the superintendent of rolling stock, who got the pipes into commission with the least delay; the cubical contents of that size of pipe making a reservoir of no mean capacity, and just the thing to draw from with safety in car-testing. It might not be the result of well-directed effort, so much as opportunity wisely taken advantage of, but there was no moralizing done until after the pipes were well under ground for their new duties.

Forging Brake Rods.

Brake-rod construction is one of those jobs that permit of a vast number of routes to the desired goal. Among the interesting methods of making a good job, may be cited those of the Louisville & Nashville road. The whole rod is formed from material in the jaws (in the case of bottom rods of the inside brake), enough stock being put in at the start to form a jaw and leave sufficient of the body on each jaw to weld together and form the complete rod with jaws at each end.

The jaws are made of two separate pieces of ¾ x 2½-inch iron, with the holes punched in each piece. These pieces then have a pin dropped in one hole to hold the two parts in register while the opposite ends are welded so as to be made into a jaw and draw down into a part of the body, the latter being scarfed for welding. The two parts are then welded and the jaws opened to size, finished—only two operations, and those in the Bradley hammer.

Motive Power for Street Railways.

The street-car companies of several leading British cities have lately sent representatives to America, to investigate the motive power employed on our street railways. At present there is very little motive power employed on English street railways except horses, but the owners of the roads are now awakening up to the fact that better and cleaner motive power can be employed with advantage to all concerned. They have investigated our cable systems, all our electric systems, and the use of air as a motive power.

An official connected with the Liverpool Tramway System has been here lately, and he seemed to be so very much struck with the advantages of the compressed air motor used on One Hundred and Twenty-fifth street, New York, that he employed an expert to make a thorough investigation of the working of the system and all expenses connected with it. The report of this expert concludes:

"Looking at this system from a mechanical point of view, there appears to be no doubt of its efficiency. The details connected with the service which we examined have been very carefully wrought out and constructed, and the machinery appeared to have sustained no wear and tear of any moment after the continuous service of about eight months.

"The arrangement of the machinery in the car is that of a plain simple engine, the working parts are of good strong section and design, and should last for a long time with a very little upkeep, and we have no hesitation in stating that a plant fitted upon this system, with the arrangements and details carried out properly to begin with, would work as great or greater efficiency and more economy than any other system which we are acquainted with."

The Buffalo Forge Company have received an order for two engines to be sent to St. Petersburg, Russia. The engine department of this company is reported to be very busy and unable to keep up with orders.

The Nashville, Chattanooga & St. Louis have within the month put in a 43 and 32 lever machine, for operating their pneumatic switches and signals, making a total of 136 levers in pneumatic interlocking machines put into operation since March 18th.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(39) C. M. S., Keyport, N. J., asks:

Can you explain through your paper how long the life of a locomotive boiler is, say, when new it is allowed 125 pounds of steam pressure? Have heard of many boiler explosions and in most every case it was an old boiler. A.—The life of a boiler is a very variable quantity, depending on so many factors, like material, construction, care, quality of water, etc., that wisdom of a superior order is necessary to a prediction. In general it may be said that a correctly designed boiler, worked under the most favorable conditions, ought to be in service at least fifteen years, and even longer when properly maintained.

(40) J. W. M., So. Frankfort, Mich., writes:

Can you give me a simple formula for calculating the elasticity of a coil spring, such as a common draft spring? A.—The following is used extensively in spring design: $E = \frac{d^3 W}{C D^4}$ in which E = compression or extension of one coil in inches, d=diameter in inches from center to center of bar, W=load in pounds, D= diameter of bar in sixteenths of an inch, and C=a constant which is taken at 22 for round steel. The deflection for one coil as found above is to be multiplied by the number of coils to get the total deflection of the spring.

(41) W. J. F., Columbia Heights, Brooklyn, asks:

1. Do not engineers on night runs on locomotives have some trouble in observing the working of sight-feed cylinder lubricators? A.—There is no difficulty in noting the working of a lubricator at night, if the proper illumination is furnished. 2. Do the sight-feed glasses often break, and can they be replaced before the end of the run when broken? A.—It is a rare occurrence for them to break, and new glasses are put in on the road at the first stop by closing the steam and water valves. 3. The N. Y. C. & H. R. R. R., I believe, does not use any sight-feed lubricators; can you say why not? A.—We do not know. 4. What is the best locomotive cylinder lubricator that you know of in this country? A.—It is not within our province to answer this question. They are all good.

(42) L. L. M., Hamlet, N. C., writes:

Please explain what advantage is had in setting a valve on an engine as described below: First, get the blades properly divided; second, move the eccentrics so that the valve will be line and line; third, then lengthen the blades so that the valve on the front center will open 1-16 inch, and will be blind 1-16 inch on the back center. I claim that the lead should be the same on both centers. Am I right or wrong? A.—The trend of opinion among many valve motion experts at this time seems to be in the direction of negative lead in the back motion, with a varying positive lead in the forward motion; the claim in favor of this practice being that an engine rides smoother, has a better steam distribution and steams better. Our position in the premises is that an equal lead adjusted for the running cut-off will give results perfectly satisfactory.

(43) O. E. H., Hunter, N. Y., asks:

What is meant by a right-hand lead and left-hand lead engine? What is the difference between the two? A.—A right-hand lead engine, so called, is one in which the crank on the right-hand side is always in advance of the crank on the left-hand side, when the engine is running ahead. The contrary holds true for a left-hand lead engine. This is clearly demonstrated by bending a piece of wire into the shape of an axle with a crank at each end, and slowly turning it between the fingers; it will be found that a right-hand crank will be ahead while running forward, and will follow the crank on the left end of the same axle when running backward. From this it will be seen that a right-hand lead engine will have the right-hand pin on the forward center when the pin on the left side is on the upper quarter, and a left-hand lead will have the left-hand pin on the forward center when the pin on the opposite side is on the upper quarter.

(44) G. W. H., Chicago, Ill., writes:

1. I do not fully understand the operation of the compressed-air locomotive, and therefore have a few questions. I would like to ask, to begin with, does the air, after passing the reducing valve, enter into a chamber with water and steam, or does it pass through a chamber heated by this steam? A.—The air passes direct into a chamber containing hot water at a pressure of about 150 pounds per square inch. 2. Water at 350 degrees Fahr. is steam at 125 pounds; now, how is this heat or steam kept up? You say that the water is heated and a portion supplied, etc. What does this mean? A.—The original idea in connection with the steam chamber was to heat and re-expand the air, but experiment in service demonstrated that the moisture taken up by the dry air made the device more efficient than when the air was made to pass over a heated surface only. The heat of the steam chamber is, of course, gradually dissipated and falls until the chamber is charged again.

(45) J. C. C., Bowling Green, Ky., writes:

We have an eight-wheel passenger engine doing the same work as two other engines of about the same size, and her cylinders will groan, although we may give twice the quantity of valve oil that the other engines get. There is no leak in the oil pipes, the engine carries water good and her dry-pipe joints are all right. What is the cause of it, and can you suggest a remedy? A.—The trouble may be caused by the piston packing fitting too tightly against the walls of the cylinder, or the intermittent action of the lubricator, due to a higher pressure on the cylinder end of the pipe, than that on the condenser of the lubricator. This latter condition of things is likely to attend all speeds with a full throttle, more especially if the lubricator steam pipe receives steam from a fountain. In that case the remedy would appear to be in a device that would reduce the pressure at the steam chest or increase it at the lubricator. A very common cause of oil waste at the lubricator is that of cylinder packing too large for the cylinder.

(46) F. W. L., West Chester, Pa., writes:

Will you please tell me, through your paper, the proper way to tram an engine, and at what points to tram from? A.—The tramming of an engine is in itself a very simple operation, if by tramming is meant an application of the tram points to axle and pin centers, which only demands that those centers shall be small and accurately located, and the tram points sharp; otherwise the results will be of little value. The first operation is that of tramming the shoes (squaring them) from the joints of the back cylinder heads, or from the truck center-pin when that is known to be central between the cylinder axes. Assuming that these points are correct, and that the driving boxes are bored centrally, the wheels are put under the engine and the wedges are set up tight enough to move without sticking. Tramming the distance between centers of axles on both sides, the pins on one side are next brought into agreement with the trams. The engine is then moved one turn of the wheels, and the trams tried on the pins on centers and quarters on each side; if the pins do not come in tram, they are either not quartered correctly or are sprung.

(47) H. T., Paducah, Ky., writes:

1. In discussing the merits of different makes of engines, the remark was made that a few years ago the Brooks Locomotive Works manufactured some engines that would, to use the relator's language, "nearly tear themselves to pieces if dropped in the corner while running shut off;" hence, engineers would drop lever but three or four notches. Can you tell me the peculiarity in construction of these engines, or what was the matter with them? A.—We cannot diagnose such a case without some particulars of the valve motion's construction. Cases have been of common occurrence in which ten-wheel engines have stripped themselves of valve gear, by breaking rods, or eccentrics or

straps, or all three, by reason of having long bent eccentric rods; these engines require care in handling the reverse lever when going at speed, on account of the lack of rigidity in the eccentric rods. It is possible that a similar construction might have been the cause of the trouble you speak of. 2. At what part of the stroke of the piston does expansion cease, release take place and compression begin with a 17 x 24 engine working in the 6-inch cut-off. The valve has 5-inch travel, ¾-inch outside lap, line and line inside, ports 1¼ x 15 inches, and bridges 1⅛ inches? A.—Data are rather imperfect on which to base an answer to this question, since lead is not given for full stroke, nor length of eccentric rods, but an approximation, leaving out the missing elements, will show expansion to end and release and compression to begin at about 16 inches of the stroke.

Difference in Fuel Consumption of American and Foreign Locomotives.

A railroad official who is interesting himself very seriously in fuel-saving methods, writes us:

"What is there in the design and construction of those large modern English locomotives, referred to in the December and January issues of 'Locomotive Engineering,' that enables them to haul express trains weighing from 225 to 250 gross tons, at an average speed of 50 miles per hour, with a fuel record of 24 and 30 pounds of coal per mile, respectively; while engines operating American trains of equal weight and speed use from 65 pounds to 85 pounds of coal per mile? If these records are correct, are they not probably due to the greater care taken of the engines, and to a more careful and intelligent system of firing than usually prevails in this country?

"The difference between the averages of these two fuel records is 48 pounds, or 64 per cent. in favor of English engines. Now, assuming that these figures correctly represent the difference between the total general average of locomotive coal consumed by English and American railroads, let us see how much money is being expended for fuel in this country over and above the amount that would be required if the coal record were as good as that of English railways. In 1896, the total amount of locomotive fuel used in the United States cost, approximately, $85,000,000. Had this amount been reduced by 64 per cent., enough money would have been saved to pay a dividend of about 1 per cent. on the capital stock of all American roads.

"What are master mechanics doing to put an end to this extravagant use of fuel? Surely they do not intend to wait until some enterprising coal dealer, learning of these extraordinary records, steps in with a guarantee to supply the fuel that is necessary for locomotive use at a reduction of from 25 to 50 per cent. per mile run, and undertakes to instruct locomotive foremen, engineers and firemen in the proper care of their engines and in the economical use of fuel, which action seemed necessary a few years ago to make our mechanical friends fully realize the magnitude of the extravagance in the use of oil?"

Cylinder Cocks that Indicate Fall of Air-brake Pressure.

On the Nashville, Chattanooga & St. Louis Railroad, they have a very ingenious scheme for handling cylinder cocks. Underneath the running board, immediately behind the cylinder saddle, they place a 2-inch cylinder made of gas pipe, about 15 inches in length, into which is fitted a piston that is fastened to the rod that formerly connected the cylinder cock lever with the cab. One end of this cylinder is connected to the train line and in the other end is a spring graduated to move against the pressure when the pressure falls below 62 pounds to the square inch. No other means of handling the cylinder cocks are provided.

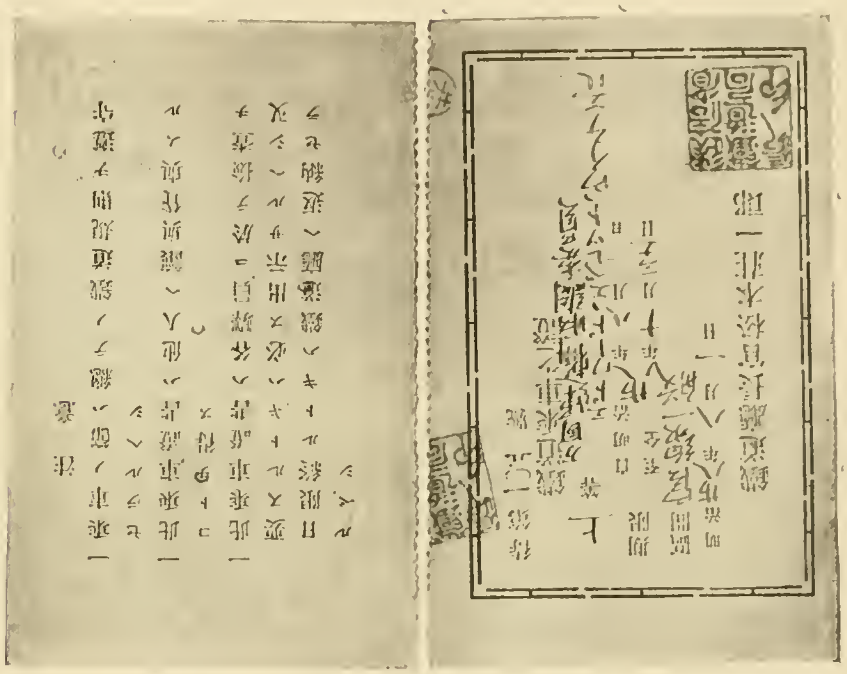
This device does two things; one, when the air pump is stopped and the pressure goes down, the cylinder cocks stand open all the time and are never closed around the shops and roundhouse, which is a desirable feature. Another advantage is that, should the engineer by neglect or oversight, allow the train-line pressure to fall to 62 pounds, the cylinder cocks will fly open. This warns not only him, but everyone else, that the train-line pressure has gone below a point that it is deemed safest to carry.

We may be sure that no engineer will allow the cylinder cocks to keep open if his pump will supply air enough to maintain his regulation 70 pounds. Mr. Thomas, assistant general manager, intends to simplify the rigging by putting the piston between the cylinder cocks and doing away with levers and rods, but the present form was the simplest and quickest to equip their engines, costing very little money.

An Odd Pass.

Our photographic reproduction shows an annual pass, front and back, over the Imperial Railway of Japan.

This pass was given to Mr. E. E. Winchell, the artist of the American Railway Commission that went around the world gathering data about railroads for the Field Columbian Museum, and for the subject matter and illustrations for "The World's Railway."



PASS FOR CHINESE RAILWAY.

Across the printed front of the pass will be seen some characters written in by hand. These state the name of the party to be passed, and the reason thereof.

On the back is the conventional notice about the company not being responsible for the loss of baggage, etc., on account of free transportation.

The Traveling Engineers' Association has sent out a circular calling for information about "The Economy in the Use of the Brick Arch in Locomotive Firebox." The committee appear determined to find out all they can about the use of the brick arch, for they have sent out eleven questions to be answered.

Don't fail to read the article on page 445 about "a splendid book."

Smith Shop Formers and the Steam Hammer.

The progress making in all lines of railroad work cannot be better exemplified, perhaps, than by a reference to the improvement so plainly in evidence in the blacksmith shop, that is presided over by an ambitious foreman—one who is not slow to take advantage of any opening that will cheapen the cost of output while maintaining the standard of excellence, and has, among other valuable qualifications, that of framing and executing schemes to beat previous records.

A few examples of original methods for forcing iron into shape are illustrated herewith. They show the earmarks of the mechanic, and will be found interesting samples of good smithing. Fig. 1 shows how a rod strap is bent to shape. *A* is the strap first made into a straight piece, with a boss forged on for an oil cup, and the back at the center enlarged at the points corresponding to the corners to insure a square finish after bending. The former for the rough bend is a rectangular post with a width that will give the rough inside dimension of the strap, and has a cylindrical end at the bottom, resting in a heavy casting. At the top there is bolted on two sides, a strap with a keyway through it, and by means of these and the key, a rod strap under construction is held and the ends are bent down roughly by a few blows of the sledge, into the shape shown in dotted lines. This operation is quickly done because the job is held rigidly up to its work by the key, and when set centrally on the post and keyed solidly, there is a certainty that the two legs of the strap will be of equal length after bending, which is the preliminary to finish by manipulation under the steam hammer.

Fig. 2 explains how the strap is handled in the final stage of completion. It is placed in a U-shaped clamp whose key at the same time firmly holds in place the bar *B* by which the strap is handled on the anvil of the hammer. The clamp also holds the block *C* in place while the huge flatters *D* are interposed between the hammer and the strap in the shaping process, alternately as shown, the key getting a blow meanwhile to keep the holding bar taut, as the closing in on block *C* gives warning of the completion of the job, for which only a few blows are necessary, for the reason that the foregoing was done while the strap was in the straight piece, as shown in Fig. 1.

Rock-shafts and arms are forged solid in one piece, and the arms are afterwards bent in a block of peculiar shape, as shown in Fig. 3. The block has a solid end piece projecting upward, and another part not so high that is recessed to admit the rock-shaft and serves as a guide while

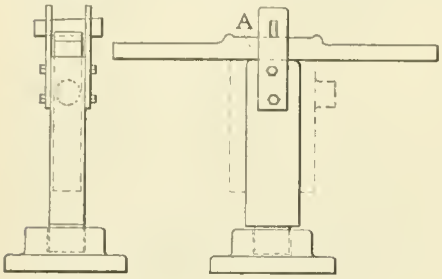


Fig. 1

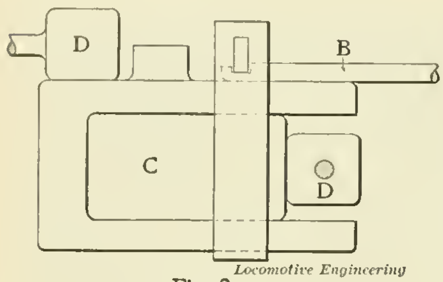


Fig. 2

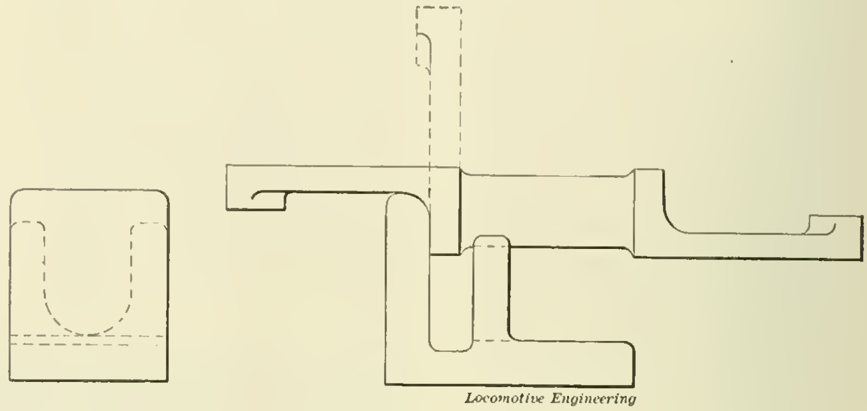


Fig. 3

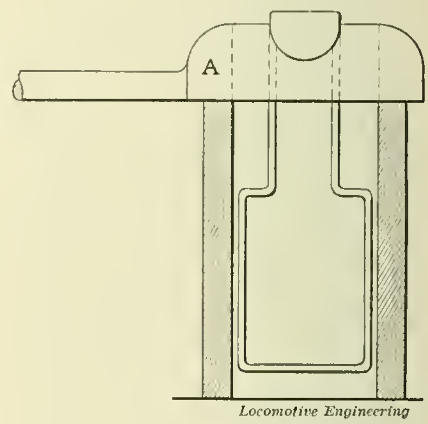


Fig. 4

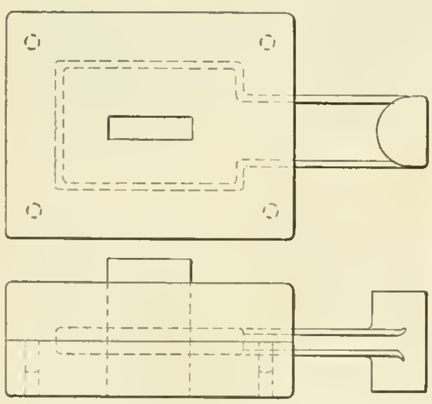


Fig. 5

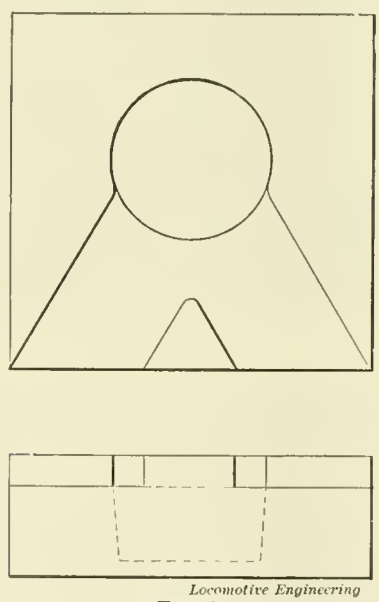


Fig. 6

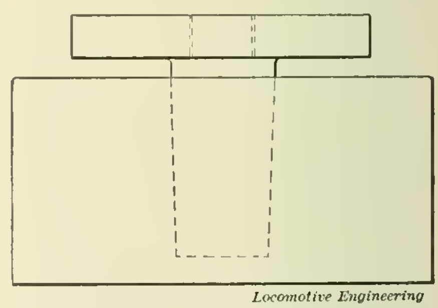


Fig. 7

FORMERS FOR LOCOMOTIVE WORK.

bending the arms. To bend the arms to the position shown by the dotted lines, the rocker is laid on the block as seen in the engraving, and filling pieces (not shown) of variable heights are placed under the opposite end while the steam hammer by successive blows forces up the arm resting on the upright at the end of the block. After treating the other arm in a similar way, there is but little to be done at the anvil in the way of finishing touches.

Spring hangers are rough forged to shape and the T-end is brought to the required curve by the former *A*, Fig. 4, which rests on a heavy wrought iron ring into which the flat end of the hanger drops while on the anvil. A blow of the steam hammer suffices to put the curved end in form. The rectangular slot for the gib in the flat end of the hanger is made by placing the end in a die made in two halves, with a slot corresponding to the size of gib, into which is fitted a steel punch of the size of the slot. Pins hold the dies in correct register when the hanger is in place to be punched. The steam hammer continues the good work begun on the opposite end, and drives the punch shown in Fig. 5 through the hanger, and forms the gib slot.

The two hangers used to support the water scoop on tenders, consist of a heavy boss which is in the nature of a trunnion and has two arms. This furnishes another good pretext for the use of a former, which is shown in Fig. 6. The boss and arms are laid separately on the die at a welding heat, and the steam hammer smashes the three pieces into one, welding and forming the job at one operation, and leaving the hammer completed except for the cutting to required length of the arms.

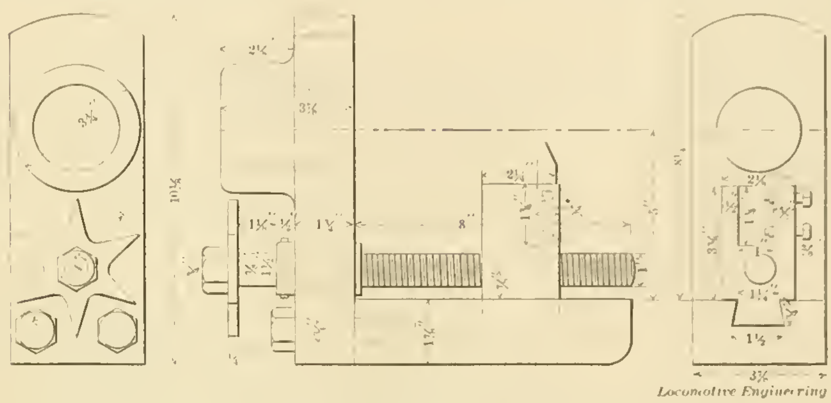
Suspension pads for supporting boilers mounted above the frames, also come in for the same treatment, in the die shown in Fig. 7. These pads are rough sized to ¾ inch thick and 10 inches square on the rectangular part, and have a body 3½ inches in diameter by 6 inches long. The merest tyro at this work knows that jumping the journal onto the plate, or ordinary welding, would be unsafe for the office performed by the pad. The die removes all uncertain factors at once, for the reason the steam hammer makes a perfect union between the two pieces, by the method of roughly shouldering the journal into the plate, as shown in the engraving, before any welding is attempted. The hammer simply makes them one piece, and the blows are continued until the plate is brought to the proper thickness.

In the case of the rocker arms we believe it will be conceded that a continuous unbroken fiber is preferable to a welded job, and that the means by which it is accomplished is mechanical as well as unique. The dies and formers described, are original and effective, and as rough as they are good. Foreman Dobbins waited for no machine work, but dug and carved them out of any material that had stock enough in it for the purpose. Results were what he wanted, not finish.

Lathe Attachment for Tumbling Shafts.

One of the best tools for what we used to term certain side issues—that is, a job that required a special treatment in the lathe, like rocker-arm bosses, or tumbling shaft journals—is that shown in our illustration. By its use some perplexities are averted, as, for example, it is not necessary to take a tumbling shaft to the smith shop and have the reverse shaft arm bent over on itself in order to let the shaft swing on the lathe centers.

The device is both simple and cheap; as shown, it consists of a right-angled piece, one of the arms being bored and threaded to fit the lathe spindle, and the other fitted with a V-slot to carry a tool head which is actuated by a screw through a star wheel. Such an attachment must prove a valuable adjunct in a shop, no matter whether they are equipped with tools large enough to swing a job like a tumbling shaft or not. This tool makes it possible to do the job in any lathe; it is one of the good things we unearthed at the New York, Ontario & Western shops at Middletown, N. Y.



LATHE ATTACHMENT FOR TUMBLING SHAFTS.

Lake Shore & Michigan Southern Annual Report.

One of the most interesting annual reports that come to this office is that of the Lake Shore & Michigan Southern. The Twenty-seventh Annual Report of that railway has been received, and it contains a great many interesting facts. One of them, which is by no means gratifying, shows that the company collected almost a million dollars less in 1896 than they did in 1895, and the operating expenses had to be reduced in proportion. The reduction does not seem to have been made at the expense of efficiency, however, for we find that 109 miles of new steel rails were laid and 602,277 new crossties put into track during the year.

In connection with the track department, there is a table given of the number of tons of rails put down each year since 1889. A curiosity about this statement is the price paid per ton for rails. It was understood that there was no break in the price of steel rails until the end of last year, but we find that in 1895, steel rails were purchased at $22 and $23 per ton. For five years before that the price kept up to the neighborhood of $30 per ton.

The company owns 20,464 cars; 19,450 new wheels and 1,326 new axles were used during the year to keep up the equipment. They have 548 locomotives, which made average mileage of 32,510 miles per engine. Twenty-five miles were run to the ton of coal, and 1,920 tons of coal per day were used up in keeping the locomotives going, besides 5,161 cords of wood, the latter being spread over the year. The cost of fuel per locomotive mile was 5.45 cents.

The hours of labor in Europe are a checkered schedule. In many cases they differ widely between those of the United States and Great Britain, and are certainly not in favor of the working classes. Antwerp is happy with but 11 hours, with some heavy fines for a loss of ten minutes. In Herstal, metal workers have a day of 15 hours. In Courselles, 18 hours a day is not thought intolerable. The hours of work in Switzerland range from 60 to 65 a week. Metal workers in Sweden average 10 hours a day. Brussels slates 11 hours. Tupize has 11 hours on the schedule, and the fine of a day's pay if a workman absents himself from work. These are among many of the facts obtained by British delegates sent to investigate the conditions of labor in continental Europe. These inequalities of time count seriously in the competition of costs and the healthy conditions of industry. So long as they exist, there is a broad field for labor reform.

Busy men who have to figure on tractive power of locomotives, will save time by using our tractive power computer, which is based on correct principles, and will therefore give a close approach to accuracy.

A Grinding Rig.

A useful arrangement for grinding cylinder head joints, steam pipe joints and other large jobs requiring an expenditure of muscle, has been evolved by Mr. Craig, the foreman of the Lehigh Valley shop at Hazleton, Pa. The vibratory motion necessary to a job of grinding, is obtained by fastening a disk to a drill press spindle, and connecting to the job

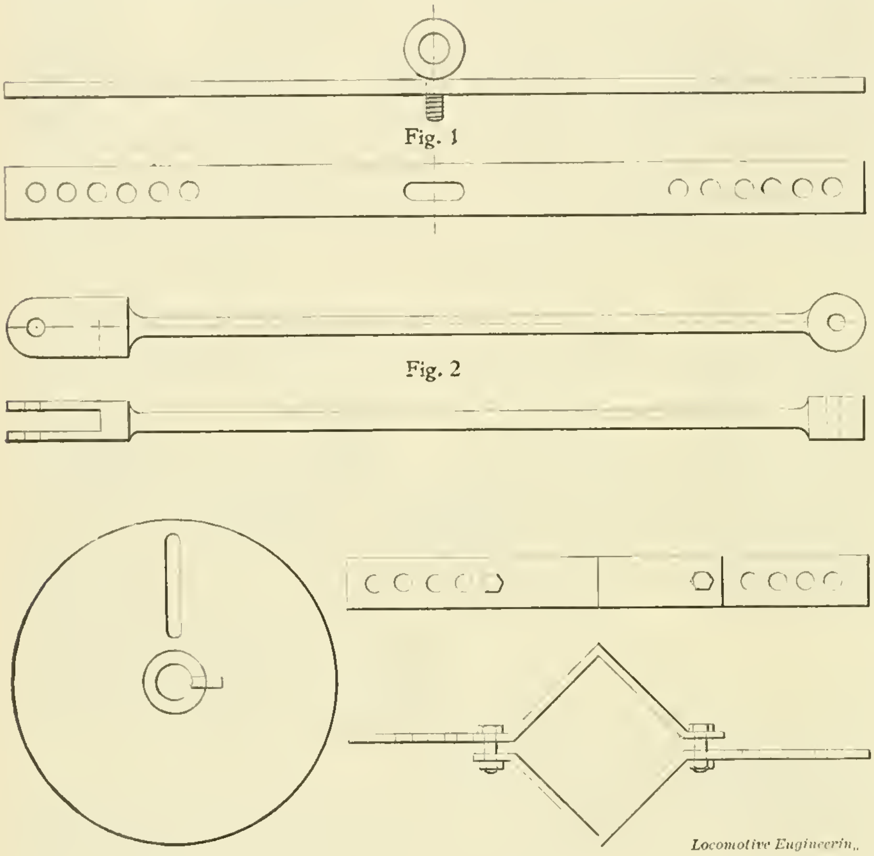


Fig. 1 Fig. 2 Fig. 3 Fig. 4

Locomotive Engineering.

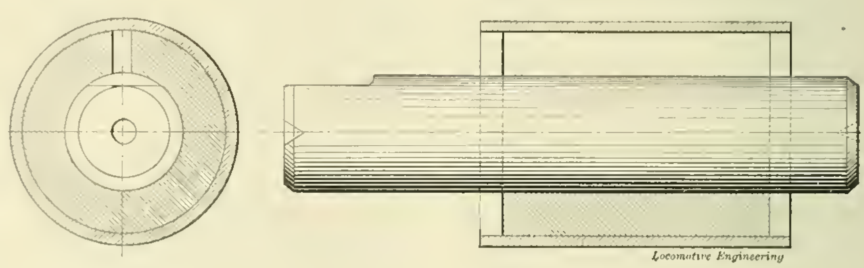
GRINDING ATTACHMENT.

to be ground, by means of a rod. The rotary motion of the rod connection at the disk is made to give a variable stroke at the end at which the grinding is done, by means of a slot in the disk, which allows of a change in the throw of the connection.

The details in the illustration show in Fig. 1, a bar 2½ x ⅝ inches x 42 inches long, which is used for a clamp on the cylinder heads. Fig. 2 is the connecting-rod, 36 inches long, having a body ⅞ inch in diameter, and a jaw at one end to engage with one end of the clamp; at the opposite end of the rod is a boss bored for a ⅞-inch bolt. Fig. 3 shows the crank disk, 16 inches in diameter, to which the rod is connected by bolting to the ⅞ x 4½-inch slot; the disk is secured to the drill press spindle by means of a ¾-inch set screw. Fig. 4 is the clamp used for grinding steam pipe joints; it is coupled up to the disk through the connecting-rod as in all other cases. It is said that by this method of grinding the time is reduced one-half—which would make it appear that old drill presses have a mission aside from making holes.

The Expanding Mandrel.

The mandrel shown in the cut does not stand as an example of a new principle in tools of that type, having been manu-



Locomotive Engineering

EXPANDING MANDREL.

factured and put on the market for some years by our best tool builders, but it is comparatively new as a factor in railroad shop economy, and we illustrate it simply to press its claims to consideration in a quarter where it is at present little known, with the hope that a knowledge of it may be the means of driving to cover the abominable one-piece affair with its uncertain path when on the centers.

There are many strong points about this tool, which embraces the use of two pieces only, one of them a tapered bar, and the other a split ring. The most telling point in its favor is the wide range of work it is capable of with one mandrel and a series of varying sized rings. The more of the latter, the higher the efficiency of the tool, and again, the rings will be certain to retain their truth, even in the hands of the vandal, owing to lack of vulnerable points of attack. If now the tapered bar, as well as the rings, be hardened and ground, they make a combination that is very desirable to the latheman.

On bushings for link work, such a mandrel is simply invaluable, possessing as it does the requisites for quick and good work, a slight blow being all that is necessary to hold or release a bush, as shown in the sectional views of the engraving. We are not aware that there is a patent on this tool, but if there is, it would pay railroad companies to own the right to build and use it, and improve the status of a well-abused tool.

Big Railroad Bridges.

The longest railroad bridge of Europe, and, in fact, the world, was recently opened to traffic with great ceremony. The new railroad bridge over the Danube river at Czernavoda is one of the most important technical achievements of recent date. For more than nine miles this bridge crosses the Danube proper and the so-called territory of inundation, which is annually under water for a certain period of time. The largest spans are over the main current of the river, there being one of 620 feet and four of 455 feet each. The total length of the bridge proper, without approaches, is 13,325 feet, while the largest railroad bridges in the world measure as follows: Tay Bridge, Scotland, 10,725 feet; Mississippi Bridge, at Memphis, 10,600 feet; the Forth Bridge, Scotland, 7,800; the Morody Bridge, in Galicia, 4,800 feet, and the bridge over the Volga, near Sysran, 4,700 feet. The clear height of the bridge over the main channel is so calculated that even at high water the largest vessels sailing on the Danube may pass under it. The clear height of the distance from high water mark, which is taken at 35 feet above low water mark, measures 105 feet to the lowest rafters of the superstructure. The caissons upon which the foundations of the bridge-piers rest, reach to rock-bottom at 115 feet below high water mark.

Trans-Mississippi Exposition.

The board of managers of the Trans-Mississippi Exposition, to be held at Omaha, Neb., have determined to provide an extensive railroad exhibit for the transportation department.

The Department of Exhibits has opened negotiations with the management of the New York Central & Hudson River railroad to secure the old De Witt Clinton engine and train, the first passenger train ever operated in this country.

One of the five passengers carried by this historic train is a resident of Bancroft, Neb. His name is Giles P. Ransom and he is 84 years of age. He is a hale and hearty specimen from the hills of Vermont and one of the most promising citizens of the flourishing Nebraska town where he resides. Mr. Ransom was a prominent figure at the World's Fair, where he formed a part of the exhibit of the first passenger train, and he has written the Department of Exhibits of the Trans-Mississippi Exposition that he will be glad to perform the same duty in connection with the exhibit here.

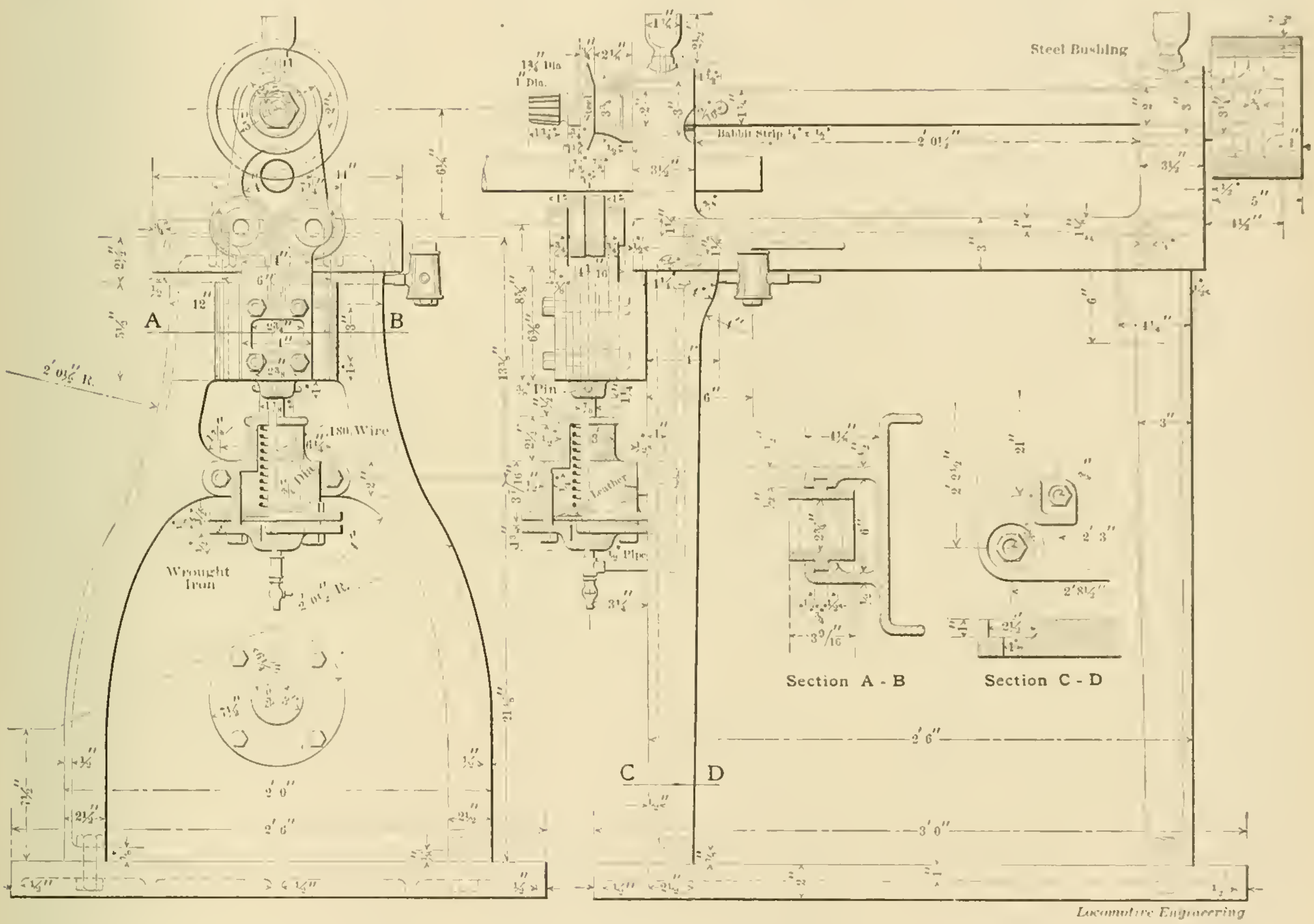
This historic old relic made its first trip from Albany to Schenectady August 9, 1831, and Mr. Ransom, who at that time was about 18 years old, was one of the five passengers. At that time the railroad was known as the Mohawk & Hudson River road, but is now part of the great New York Central system.

If this engine and train can be secured, it will make a fit companion piece for the car which was used to convey the remains of the martyred Lincoln from Washington to Springfield. The old car is now the property of the Union Pacific and the officials of that road have agreed that it shall form a feature of the transportation exhibit.

Flue-Cutting Machine.

An improvement in flue-cutting machines has been apparent of late to those who follow up the status of boiler-shop tools, and our engraving of one of the latest productions of the kind tells plainly how well they have evoluted into a good thing. There are no radical departures from the familiar old lines, but an adaptation of air to the machine is what has revolutionized its convenience and capacity.

This has been accomplished by the application of a 4-inch air cylinder to the frame of the machine, and the piston brought in line and connected with the rollers on which the flue is supported and carried to the revolving cutter. An admission of air to the cylinder raises the rollers and with them the flue, to the cutter with any degree of pressure desired, by means of the valve within easy reach of the operator. A coiled spring within the cylinder assists gravity in returning the piston to its original position when release takes place. This tool was found among the labor-saving air devices gotten up by Mr. J. B. Barnes, superintendent of motive power of the Wabash Railroad.



FLUE-CUTTING MACHINE.

One of the perplexing problems about shop work is the drilling of staybolts after they have been put into boilers. A great many ingenious rigs have been gotten up to do this by power in an economical and expeditious manner, and our mechanical readers who have undertaken this kind of work will be interested to know of something new in this line which has recently been put into operation at the Baldwin Locomotive Works, that is the punching of the hole in the end of the bolt. The bolt is heated, held in a box die, and a steel punch the proper size is forced into the end of it. They are not gingerly about the distance they force it in, for it seems to be perfectly easy to make the hole 3 or 4 inches deep. Such an operation is, of course, very quick and must be a considerable saving.

Notes of a Journey in Scandinavia.

BY W. J. MC CARROLL.

As the notes on "Russian Railroads" have been published in February number of "Locomotive Engineering" and appear to have been received with some little favor, I will make another attempt and furnish a few notes on a trip from St. Petersburg through Finland, Sweden and Norway, with a few notes of the Norwegian State Railway, as I believe many of the readers of "Locomotive Engineering" are interested to learn what is going on in foreign countries.

The most favorite route from St. Petersburg to Sweden is by the Finnish steamboat line, which leaves three times a week. The boats are modern and furnish excellent accommodations in every respect.

When leaving St. Petersburg, the vessel steams out through the Neva River, and one is reminded by the scenery of going along the Clyde by the large ships and steamboats laying to for repairs. In a short time we are in the waters of the Gulf of Finland, and making a direct line for Helsingfors, on the coast of Finland. The steamer stops about six hours, giving one ample time to get a view of the town. As this is the capital of Finland, it has many handsome buildings and is somewhat a summer resort. It has many beautiful tea gardens and places of amusement. The University and Senate House, museums, libraries and buildings of this sort are to be admired for size and architecture. This town is often called the Gibraltar of the North on account of the great forts located at the entrance to the town, which have some ninety heavy guns pointed directly to this entrance.

After leaving here the next stop is at Hangö. The next stop is at Abo. From here we sail out through the Aland Island Archipelago. After sailing twenty-four hours the steamer arrives in Stockholm, Sweden. This city is classed as one of the finest in Europe for position, and is often called the Venice of the North, as it is situated between Lake Malor and the sea, and erected on seven rocky islands. There are many places of interest in the suburbs that can be reached by going from one island to another by steamboats or gondolas. There are also many fine museums, galleries, libraries, parks, etc., to visit.

From Stockholm the route was north over the Sweden State Railway, passing through a continuation of heavy timber land, trees mostly pine and fir, now and then stopping at pretty towns. There are no farms of any account, but one will see many sawmills and occasionally stone quarries. The ride was interesting, as many beautiful valleys and lakes are along the route. At Storlien is the end of the Sweden State Railway, and the Norwegian State Railway makes the connection, which is 66 miles from Trondjhem, which is in the northern section of Norway.

Norway and Sweden, as all are aware, is but a small speck on the map of the world, and is a peninsula located in the northwest section of Europe. While they are designated by two different names, they are in reality under one form of government, but conducted and operated entirely separate. The combined area is 297,377 square miles, Norway containing 124,500. It is very mountainous, the winters severe and long, and in the northern section the summer not long enough to ripen corn or raise potatoes. The North Cape, in latitude 71 degrees 10 minutes, is now the attraction of many tourists who go to see the midnight sun. This scenery can only be described in a few plain words as follows: From May 11th to July 30th the sun never drops below the horizon; consequently, it can be seen all hours during this time, except when cloudy, and at 12 o'clock midnight it is almost perfect day. For a longer time in the extreme north there is no perceptible difference between night and day.

At Trondjhem, the northern metropolis, one will find the operating department and main shops of the Norwegian State Railway, with Mr. Jacob Greenawolt as superintendent of motive power and machinery, and Mr. O. Galverstadt as master mechanic. I might here mention that Mr. Greenawolt is quite American in railroad and shop practice, as he was for a number of years employed in this country on several railroads, and for a time as master mechanic of the Lake Shore at Buffalo, N. Y. When his native country began to build and operate railroads, they wanted practical men at the head of them, and he was induced to return home and accept the position he now holds. Mr. O. Galverstadt is also a man of wide experience, having traveled and worked in a number of foreign countries.

All railroads in this country are controlled by the Government. They have about 1,200 miles in operation, and about 150 miles being constructed; some lines are narrow gage and some standard gage. The lines, as must be expected from the surface of the country, are very crooked, with heavy grades, many bridges and tunnels. There is very little mining done, except the copper and iron ores. The freight-hauling business is generally composed of general merchandise, fish and lumber. The coal used on the locomotives is imported from England.

In the car shops the machinery is driven by a rope belt about one hundred yards in length from the main shaft of the machine shop. In this department will be seen a good assortment of modern woodworking machinery, some of American manufacture; one will also see many small hand tools of American make. The car shops for general heavy repairs and building new cars will hold sixteen cars. The paint shop will hold twelve. This shop is well arranged for this purpose, heated independently and ventilated to get good drying air; also arranged for special light. It was interesting to note some schemes of car-building designed by Mr. Greenawolt. They had a number of small four-wheel passenger cars in service, which were quite bothersome as to the number they were obliged to keep shifting in making up trains and repairing of couplings. He took two of the small cars, cut off the ends, butted the bodies together by riveting heavy iron strips to the channel-iron frames, and joining the woodwork in a substantial manner and putting four-wheel trucks under each end. He has a good-looking and well-proportioned car, which rides well and gives better satisfaction all around than the short cars. He has also designed a new third-class passenger car which I believe will be interesting to mention.

This car is for the narrow-gage lines, and is 54 feet long, 7 feet wide and has a seating capacity for seventy-four people. The frames are channel iron, cross-braced by a number of diagonal braces, and have four 1½-inch truss rods, double trucks under each end. The ends are vestibule pattern, and have doors on ends and sides, so as passengers can enter or leave the car either way. It is lighted by lamps placed in the roof, heated by stoves carried underneath the cars; it contains a water-closet in the center, and has two of Major's patent water filters and coolers for drinking water, one in each end. The windows are large and drop-down style. The car is finely finished by paint on the interior. The outside is finished in plain teak-wood, with four coats of varnish, plainly lettered and numbered, without any striping or ornaments. The teak-wood siding is fastened on by copper nails put in with some care, and when sandpapered smooth and varnished makes a good appearance. Mr. Greenawolt claims that this is the most durable wood and finish for the outside of passenger cars he has been able to find, as the extremely cold climate and atmospheric conditions are such in this section that ordinary finishing by painting is not at all satisfactory. One day the car may be in the north in the morning, where it is intensely cold, and in the evening in the southern section along the coast, where the Gulf Stream has such a decided effect and the weather is warm. Combined with the salt air, it gives any paint and woodwork a severe test. A number of these cars are now in service, and are satisfactory. When the dead weight of these cars is figured out for each passenger, it brings it lower than anything I ever heard of. Calculating each passenger at the average weight of 135 pounds, they then have about 3.3 pounds of car for each pound of passenger. How is this for low?

LOCOMOTIVES.

The locomotives are a variety of English, German and American (Baldwin). They recently received and had in service four new Baldwin compound narrow-gage engines that were in service and giving satisfactory results. While here I saw two Baldwin engines that had been in continual and steady service for nearly nineteen years. They were going through the shop for repairs. They had the original driving-box brasses and rod brasses, which had been refitted and still looked as if they would stand the wear for many more years. All the engines are equipped with the Carpenter air brake.

The shop and engine houses are purely American in design. They are built of stone, large and commodious. The engine house is circular in form, with fourteen tracks, and as they handle engines of both gages of track, they have some stalls with the third rail and run two narrow-gage engines on one track. This is certainly a fine engine house, modern and up to date in every way. The turntable in the center is floored over so as to avoid shoveling snow out of the pit during the long winter. It is also the means of preventing a man picking himself up after a sudden stop. I should think this would be about the proper thing to do in this country, as I have picked myself out of turntable pits on two occasions and wondered why they could not be covered. At one end of this building they have a fine wash and sleeping room for men who are obliged to remain at this end of the division overnight. The machine shop is large, roomy and well planned. The foundry is arranged at one end of the building, partitioned off by a stone wall. The brass foundry is also in a room by itself. At the other end is the smith and boiler shop. In the main shop there are ten tracks for repairing and erecting work.

All along the back wall are vise benches. Then comes the machinery, all conveniently arranged. In the middle of the shop is a wide aisle the whole length of the shop, and the heavy work from the foundry and smith shops can be transferred from one department to the other without carting around through the yard. Between each and at the end of the erecting tracks there are columns for girder supports; around these columns there are good heavy vise benches for the erecting gang. Throughout the machinery equipment one will observe many American tools, such as Putnam lathes, Sellers patent planers, Pedrick & Ayer air compressors, Olsen testing machines, and many small hand tools. Mr. Galverstadt says there is plenty of atmosphere to be had in Norway, and by getting a Pedrick & Ayer compressor to punch it through pipes, he intends to use it in many forms as soon as he can get it coupled up and connected. He has designed and is making many convenient hoists to suit the conditions of his shop and work, and will in a short time have air hoists for all his heavy machines and air presses. They were also putting up a new overhead crane to lift engines to remove the driving wheels.

Mr. Galverstadt has many devices and jigs for turning out work. Among them is a quartering machine designed expressly for the shop and purpose. It is understood a shop of this sort does not require a machine of this kind often, and it would not pay to have one lying idle, so he made one to answer his purposes, by making two V-blocks to be bolted on the large planer table. The journal of the axle is placed in the V-grooves and the wheel clamped in position, and on these V-blocks he has cutter heads that can be adjusted for different size wheels These cutters are driven by belt from countershaft overhead.

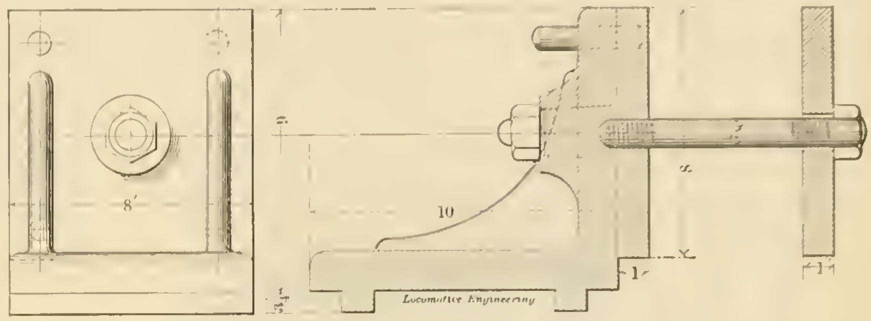
All staybolts are copper and put in the boiler by power from a rope belt, and the machine holding the chuck has a spring attachment, so as when a certain strain comes on the bolt by being tight in the thread, it slips, and this bolt must be taken out and chased The staybolts are all cut in a lathe. They claim that by using special care in having the threads and fit perfect they never have any trouble with heavy staybolts.

Philadelphia, Pa.

Squaring Device for Planing Rod Brasses.

In planing rod brasses there are quite a few settings of the job true with the square, before its completion—in fact, each face operated on must be squared with the part previously trued. With the object in view of reducing this part of the work by making the use of a square unnecessary, the device shown was built. It is only one of the regulation cast angle irons, known of all machine men, rigged up for a specific purpose. There is a boss cast on the inside face to receive a tapered trunnion from a square plate, which bolts to the outer face of the angle iron. Into this plate a stud is tapped to carry another square plate whose function is simply that of a washer.

The angle iron has one hole near its upper edge, and the plate next to it has four holes bored through its face as near an angle of 90 degrees to each other as it is possible to make them, taking the bottom face of the angle iron as a base to square from. It is plain that the locking pin will, when placed in the holes, bring successive faces of a job square with each other, and that when a pair of rod brasses are sweated together on the faces and clamped between the square plates, that a square need not be used to plane or mill the edges of the flanges, nor the body for the strap fit; it being only necessary to loosen the nut on the angle iron and revolve the job until the locking pin enters the following hole. For a rush roundhouse job of brass reducing, we should think this rig might make its influence



SQUARING DEVICE FOR PLANING ROD BRASSES.

felt. General Foreman Bailey, of the Southern Railway, at Manchester, Va., called our attention to it as a good thing.

The people of Omaha, Neb., are laboring to get up a Trans-Mississippi & International Exposition, to be held at Omaha, Neb. The State of Nebraska is not fertile with riches these days, and the advocates of the exposition are applying to outside friends for assistance. The people of Nebraska have not displayed a very friendly spirit towards railroad companies, but it appears to us that in their present need of money the railroad companies are treating them much more liberally than any other interest. When the appeals for help were sent out, the Chicago, Burlington & Quincy promptly announced that they would give a donation of $30,000, and shortly afterwards the Chicago & Northwestern took stock for a like amount. The Chicago, Rock Island & Pacific, at a meeting of directors, decided to contribute $20,000 to the exposition, and the Chicago, Milwaukee & St. Paul has devoted $10,000, although that company does not have a single mile of railroad in Nebraska.

The Monon route has recently put into use a sleeping car service between Chicago and the famous health resorts, West Baden and French Lick Springs. They have also established a new through sleeping-car line between Chicago, Washington and Baltimore, via Cincinnati As the sleeper goes through without change and leaves at convenient hours, passing through a highly picturesque route, the service is becoming highly popular.

Pilot with Folding Drawbar.

The pilot shown herewith is the standard of the Louisville & Nashville Railroad, designed by Mr. Pulaski Leeds, superintendent of motive power of the road. A pivoted cast-iron drawbar and cast-steel center piece, which extends from the nose of the pilot up to and under the bumper beam, are its distinguishing features over pilots of ordinary construction. The center member is of a rectangular section, cored to a thickness of ⅝ inch at the top and ⅜ inch at the bottom and sides. It is pivoted at the upper end to the drawbar, which is made to swing into the position shown by the dotted lines in the sectional view, and is held there by the locking pieces shown in connection with the lever by which they are actuated; the upper lock holding the bar in a horizontal position for double heading or switching, and the lower one holding it in the raised or running position.

Aside from its connection with the drawbar, as an essential part of the same, the steel center member has proved to be an improvement in point of strength, it having saved pilots from the effects of many hard blows that would have been destructive but for the steel fender. This bar was designed to fold up and run in the position shown, for the purpose of throwing live stock clear of the rails when struck, and not hold them for a short time to finally drop to the track, as was too often the case with the horizontal bar. The device does what it was designed to do, in a most satisfactory manner.

Liquid Fuel for Suburban Locomotives.

The Prescott system of oil burning for locomotives, adopted by the Atchison, Topeka & Santa Fé, in California, has been applied to one of the suburban engines belonging to the Illinois Central. The intention is to gradually convert all the suburban engines into oil burners if the smell is not found offensive to passengers. The object in doing this is to stop the nuisance of smoke and cinders which passengers complain about in the summer.

We notice that some railroad men and newspapers talk of using oil fuel for locomotives, as if it were an uncertain experiment. There is no experiment about it whatever, for hundreds of locomotives in Russia have been burning oil fuel for years, and what can be done successfully in Russia in the engineering line can be done in the United States.

One thing that has prevented liquid fuel from becoming general has been that it costs more than coal. A test of an oil burning locomotive was made some years ago with an engine on the Elevated Railroad of New York. Report was made that it was not satisfactory, but the real difficulty was that the oil costs more than the anthracite coal used, and had no advantage so far as cleanliness was concerned, over anthracite coal.

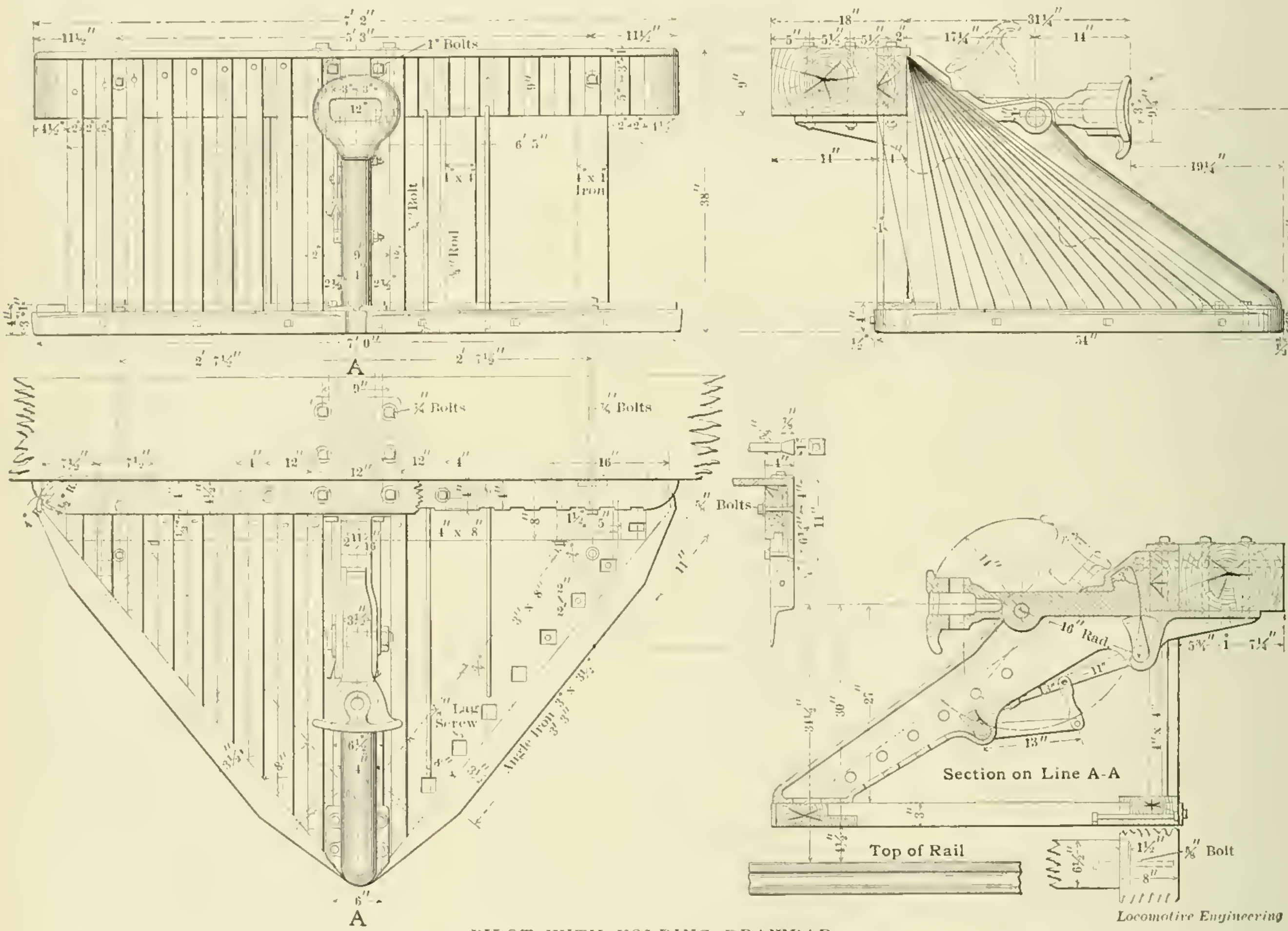
Organization of a Mechanical Department of an Early Railroad.

One of the first railway enterprises in New England was the Western Railroad, which eventually became the Boston & Albany. The Western Railroad was built under the supervision of Major Whistler, who was considered one of the ablest railway engineers in the world at that time. As the methods followed of organizing different departments of railroads in those days cannot fail to be of interest to modern students of railroad history, we submit some ancient instructions, which explain themselves:

Letter from Major Whistler, to Mr. A. Hawkins, before the latter assumed the duties of master mechanic of the Western Railroad:

Mr. Hawkins:

Sir—The Western Railroad Company in employing you as Master Mechanic to be charged with the safe keeping of all things belonging to that department of the operations of their road, expect, in addition to the especial duties



PILOT WITH FOLDING DRAWBAR.

pointed out in the general regulations that may be adopted for your government, the right to your service at all times and in such manner as they may deem for their interest. Your compensation to be three dollars per day for every day in the year, your services to commence to-day.

You will repair to Providence, call on Messrs. Fairbank & Clark who are constructing an engine for the shop at Springfield, see what progress has been made in it, consult with those gentlemen as to the best place to procure such tools as I have mentioned to you for the shop; after you have ascertained where they may be best had, and the terms, you will report yourself at the office of the Engine Department of the Company, at Springfield.

Your obedient servant,
GEORGE W. WHISTLER.
Stonington, July 29, 1839.

Mr. A. Hawkins was the first master mechanic employed on the Western Railroad. The following is a copy of instructions given him by Gen. J. Barnes, who was master of transportation at the opening of the road:

August 1, 1839.

INSTRUCTIONS FOR THE MASTER MECHANIC.

1st. Under the direction of the Master of Transportation at Springfield, the Master Mechanic is charged with the immediate superintendence of the Machine Shop Engine and Car House and all things connected with the moving power.

2d. All persons connected with his Department will be under his immediate direction. They will obey and respect him accordingly. And since he will be held responsible for the faithful performance of their duties, he is fully authorized to discharge any who shall neglect their duty or dispute his authority.

3d. Under his direction, all repairs of Engines and Cars will be executed, for which purpose, and with a strict regard to economy, he will employ a suitable number of hands in the shops of the Depot, he will inspect all Engines and Cars before they leave the Depot, that he may be satisfied all is in perfect order, and that all persons charged with the immediate care of them, have performed their duties faithfully.

4th. He will establish and preserve usual shop hours, keeping a record of all work done in shops and distinguishing the kind of work as well as the number of days work, in each kind of repairs, and on each particular Engine. He will note the time of all absentees, with the reason of their absence, and will, at the end of each and every month, make a report to the Master of Transportation, at Springfield, of the condition of the moving power; also exhibiting the work done in the shops, etc., as per foregoing instructions, and he will, from time to time, report, suggest, etc., as the interest of his department may require.

5th. He will be held responsible for all materials and tools used in his Department, and a strict economy in the use of the former, and of care in the preservation of the latter, is confidently expected of him.

6th. He may grant leaves of absence to hands under his charge for a time not exceeding one day, if their service be not required in the shop, but for longer periods the leave of absence must be approved by the Master of Transportation.

7th. On the occurrence of an accident, which may have disabled any engine or car, he will immediately make an examination of the extent of the injury, etc., and report the result to the Master of Transportation.

8th. He will, when any materials are required for the use of his department, report at the office of the Master of Transportation the nature and amount of the purchase to be made, and will receive the necessary "Pass Book," which he will take to the shop where the purchase is to be made, and there have the materials, with cost, entered on it.

9th. He is especially charged to use every possible precaution to prevent accident from fire. He will have a large cask kept constantly filled with water in the car house, car shop and repair shop, and six buckets in a conspicuous place in each building. He will visit all the buildings on the premises immediately after the hour of shutting up for the night, to see that all fires (except those in the engine house during winter) and all lights are carefully extinguished. He will see that the night watch is at his post and satisfy himself that he is properly instructed and fully understands his duties. He will instruct the watchman to ring the bell of the depot in case of fire.

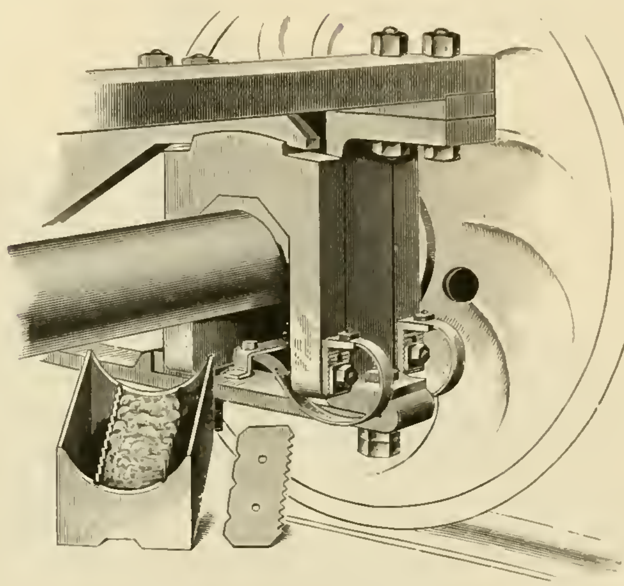
10th. He will, at the end of every half year, say January 1st and July 1st, furnish to the Master of Transportation a list of all materials and tools on hand.

J. BARNES.

To Mr. Alphcus Hawkins,
Master Mechanic Western R. R.

Pound's Journal Box.

The annexed illustration shows an improvement effected by Mr. Orange Pound, of Bartow, Fla., on engine journal boxes. The claims made for the improvement are accessibility for repacking, no tools required in removing or replacing cellar. You just place your finger upon end of tie bar and pull down about ¼ of an inch and slide cellar out. The same to replace it. No cellar bolts, no lost cellars, no slack packing, no dirty oil. The springs support the cellar and cause it to keep up close to the journal, insuring contact of the waste, and preventing dust from entering the cellar. Springs can be adjusted for the required hight.

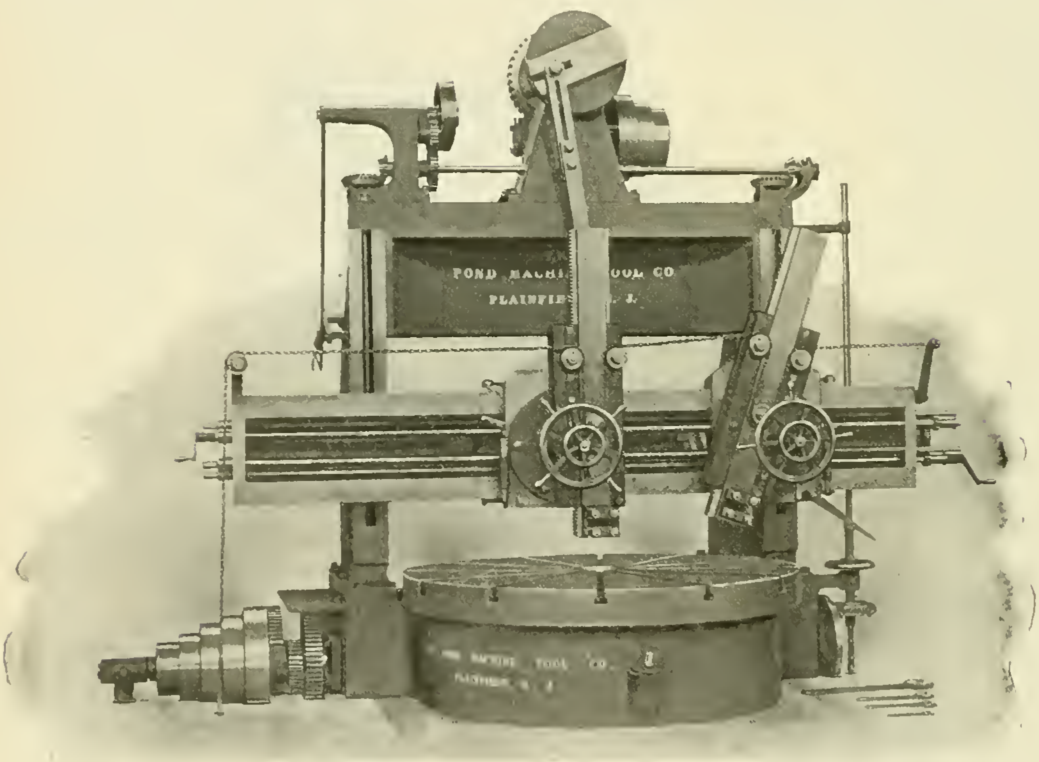

POUND'S JOURNAL BOX.

The invention has been put on the market by E. T. Silvius & Co., Indianapolis, Ind. It can be applied at very little cost to any box.

We have received from the Gould Coupler Company an elegant illustrated catalog, showing the various properties owned by the company, and the railway appliances which they make. The catalog is of the large standard size, bound in morocco leather and printed in the highest style of the art. Besides their well-known car couplers and buffers, the catalog contains very good illustrations of the Gould vestibule and continuous platform and buffer and all details of the parts forming the same. The catalog will be found a very useful reference for railroad men, and they ought to send for it.

Pond Boring and Turning Mill.

The handsome machine shown in the annexed engraving is the latest output of the Pond Machine Tool Co., Plainfield, N. J. It is an unusually powerful boring mill; swings 85 inches in diameter and 48 inches high. The face plate is 78 inches in diameter. It has ten changes of speed, and is driven by a cone of large diameter, having wide belt steps, geared to an internal gear. The back gearing is located in the left side of the bed, where it is readily accessible to the workman. It has a wide bearing on the bed, nearly equal to the diameter of plate, and is mounted on a spindle having large bearings, with adjustment for wear, and with sufficient length to prevent plate from tipping when tools are cutting at highest position. The lower bearing is mounted on a step resting on a wedge that can be adjusted from above the floor, thus lifting the plate off the bearing on the bed when required to revolve at high speeds or by hand when setting and fastening work.



POND BORING AND TURNING MILL.

Tool slides have 48 inches traverse and are counterbalanced. They have large flat wearing surfaces and fit the entire length of the swivels, making the strongest possible support. They are fitted with the most universally used tool holders of four bolts and two straps, permitting the use of ordinary lathe or planer tools. Worm and ratchet provided to set swivels at any angle.

The crossrail has large flat wearing surfaces and is elevated by power. The saddles are attached to steel feed screws by nuts which can be opened and a rapid movement obtained by ratchet and pinion engaging a steel rack on the crossrail.

The feed on each tool is independent of the other. It is operated by a disk driving a friction wheel and instantly can be changed from 0 to maximum.

For turning pulleys on an arbor, an equalizing driver plate, a saddle on crossrail fitted with spindle same as tail spindle of a lathe and center fitted to face plate can be furnished.

It has a slotting attachment, which consists of a worm driven slotted plate with pin adjustable from 6½ inches to 18 inches stroke. The purpose of the slotted connection between the plate and tool slide is to adjust the stroke to the location of the slot to be cut. The pedestal carrying the slotted plate is secured to the arch by bolts in T-slots, permitting it to be placed in line with the tool slide when located over the work. The cone on slotting counter slides to suit the position of the pedestal.

"Adirondack Mountains and How to Reach Them" is the name of the latest "Four-Track Series" of folders issued by that most enterprising of advertisers, Mr. George H. Daniels, general passenger agent of the New York Central. This pamphlet contains a beautiful colored map of the Adirondack district, and gives a great variety of information about hotels, boarding houses and places where visitors will find convenient lodgings. This folder will be found a very useful aid to people taking a trip into the mountains, and will be sent free by Mr. Daniels on receipt of a two-cent stamp.

College Graduates for Railroad Life.

Mr. W. H. Baldwin, president of the Long Island Railroad, is a graduate of Harvard and rose to his present position by successive steps from the foot of the ladder. Like all intelligent railroad managers he wishes to see well-educated men entering railroad life, but he does not consider that a good education should exempt a man from beginning at the bottom. In an article on "Railroading," recently contributed to the "Harvard Monthly," Mr. Baldwin says:

"This reference to the various departments of a railroad indicates only the great variety of opportunity in its service. I have known Harvard men in charge of each of the departments referred to. And yet very few Harvard men have gone into the railroad service. The reasons for this are probably that the dignity of railroading as a profession has been established but recently; that some college men who were entirely unfitted for the work failed and condemned it; there has been a lack of permanency of employment with any one road; but principally because the opportunities have not been made apparent to college men at the time when they are deciding their future work.

"The college man who, after deciding that he is fitted for it, begins railroad life in just the same way that he must begin any other profession or business career, at the bottom, will have no reason to fear lack of success. The opportunities for rapid advancement, however, such as existed in the earlier days, when new railroads were building rapidly, and new companies were organizing, are no longer to be found. The tendency has been of late years to consolidate the smaller companies into larger systems, thus increasing the number of subordinate positions in large systems, just as in all corporate and industrial organizations. It is certainly fair to say, however, that there is just as much need for competent men of integrity in the railroad business to-day as at any time in its history. Railroad organizations are becoming more and more permanent. To enter the service of the best roads to-day is practically a guaranty of permanent employment and permanency of opportunity is of first importance.

"Although a regular academic course of college is of advantage to one selecting railroading as a profession, there has been much discussion on the part of railroad men during the last year as to the advisability of establishing a regular course of instruction in special railroad subjects at various colleges. These suggestions have been received very favorably by several colleges, and the day is undoubtedly near at hand when Harvard and other colleges will add a regular course of four years' study in special railroad subjects, and the railroad profession will be recognized just as law and medicine are to-day. Such a course of study would not be expected to turn out practical railroad men, but it would turn out men possessed of special knowledge which would make it easier for them to rise in the railroad profession than for those without such training."

Machinery and the Laborer.

It seems to come within our province and to be our duty to notice the following recent utterance of Bishop Potter:

"The great causes of the general ill-feeling and uneasiness among the laboring classes in the United States to-day may be divided into two classes—machinery and the manner in which the capitalist looks down upon the men who labor for him. Chief of these two is machinery. It is doing away with intelligence in labor. It is turning the laboring man into a simple idiot. Not long ago I visited a large factory in this State and was much impressed with what I saw. The owner proudly showed me around, pointing out the manner in which labor was simplified. I saw a young man sitting before some sort of a large hammer. He sat with his legs crossed, and all his work consisted in shoving into an opening in the machinery a small piece of iron. He would turn the metal two or three times, throw it into a large box, and take another piece. That was this man's work, day after day, week after week. No wonder that at night time he drank, gambled and fought. He had to; otherwise he would go mad. How many of us would stand this and not cry out? Not one of us but would become a striker. Myself among the first."

We have profound respect for Bishop Potter and absolute faith in the purity of his motives. We admire the frankness of his utterance as quoted above; its sincerity is self-evident, and we think that the good bishop did well to say it. If these things are thought, as we know they widely are, the worst that could occur would be that they should be cherished in secret. Correct thought does not exist without free speech.

We believe, we can say that we know, that the bishop is entirely mistaken. The operation and effect of machinery upon the toilers most intimately associated with it is precisely the reverse of that assumed. The hewer of wood and the drawer of water, the typical and universal drudge of old, has disappeared from civilized life. Steam drives the pump and the saw. We do not know what operation of the factory Bishop Potter happened to witness. It may have required more skill than would be apparent to an uninitiated onlooker. If it did not, we may believe that it was a temporary or transition operation of a partially developed process. One of the continuous wonders of modern machinery is the application of the automatic principle, whereby all simple and monotonous operations are successively taken away from human hands.

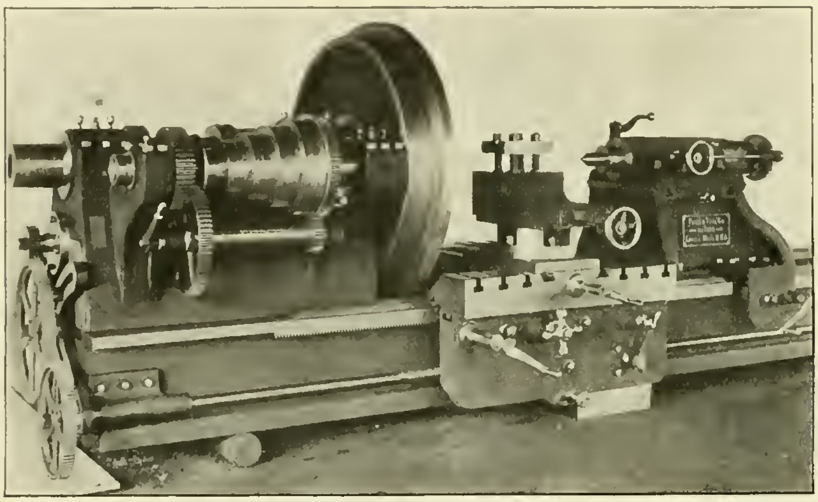
More than a generation ago we were familiar with the factories where cut nails were made. In those factories the machines were fed by boys. Lines of machines would be ranged in a long room, with a boy at each machine, a hundred or more in a single room. The operation of feeding consisted in slipping the end of a strip of iron into the nail machine, allowing it to bite off a nail, then drawing back the strip, turning it over, slipping it in again for another bite, and so on indefinitely. If Bishop Potter could have seen those boys he might well have pitied them and have thought their outlook a hopeless one. The boys were banished by the automatic feeding devices later employed. The same process is continually going on with all machinery. It is always possible to find a poor fellow whom we can well pity as the slave of some steady and constantly operating piece of mechanism, but the proportional number of such fellows to the whole community is a constantly decreasing one. It is a simple and easily demonstrated fact, which we have heretofore called attention to in these columns, that the proportion of skilled to unskilled labor constantly increases.

Bishop Potter will be able to find a lesson on the mission of machinery in the means employed for the erection of the cathedral of St. John the Divine. The derricks that stand in the midst of that noble work represent the emancipation of man by machinery from the most unwelcome phases of his toil. When the vast pile shall have been completed, it will, as a whole, be the work of a higher average class of men and a better paid class of men than have ever built a cathedral before. It will show more work per man employed than ever before. We do not believe that Bishop Potter could or would pull down the derricks. He might regard with pity the engineers of those derricks as in process of transformation into simple idiots—if we may be pardoned for the application—but what of the thousands of sweating, tugging, shouting men that would otherwise be required?

It is, of course, true that the attendance of automatic machinery often involves monotonous labor, but this proves nothing. The real question is, Which method involves the least amount of toil—that in which the forces of Nature supply the power and the hand merely directs, or that in which the power must be supplied by human muscle? If brain work is given more play and muscle work less, where is the drive toward idiocy? To this there can be but one answer.—"American Machinist."

A New Lathe.

The lathe recently put upon the market by the Fifield Tool Company, of Lowell, Mass., a cut of which appears herewith, especially commends itself for heavy railroad use, as its swing and capacity is such as to perform all the functions of the wheel lathe and at the same time is available for every range of ordinary lathe work. It is an entirely new design, and intended for heavy work. While it is intended for heavy work, the construction is different from any others ever put upon the American market. The main spindle can be driven with an open belt, with back-gears, with open belt through internal triple-gear, with back-gear and internal triple-gear, thus revolving the main spindle at the same rate of speed as the cone and side spindle or at the same rate of speed as the side spindle when back-gear is in; and with the powerfully triple-geared head twenty different speeds can be obtained, or all the speeds of the main spindle that can be gotten in a plain back-geared lathe, thus enabling the performance of the same variety of work that can be done on smaller lathes. The whole construction is so arranged that it can be handled with ease and facility. They especially invite attention to their table of dimensions, which is sent on application.



FIFIELD'S NEW LATHE.

Laws Relating to Fencing.

The general manager of a Southern railroad writes us:

"After reading the very interesting editorial correspondence in your number for May, and the very just comments of the writer upon the respective conditions abroad and in this country about railroad rights of way, I am disposed to believe that he also will be interested in learning about the respective rights of stock and trains upon railroad tracks in North Carolina, for instance: In that State it is not only not a trespass for stock to be upon railroad tracks, but in fact it has certain rights there, which are almost equal to those of trains. In the event of collision the respective rights are challenged, the presumption of negligence and burden of proof being against the railroad company.

"Further than that, it is no trespass for one man's stock to be upon another man's premises, and if the latter wishes to keep stock off from a field of young corn, he must fence it; and if the stock gets inside of the fence, it must be gotten out without injury. Therefore, if constant litigation and annoyance with one's neighbors is to be avoided by a railroad company in that State, trains must be run with reference to the rights of cattle on the track.

"To be sure, the cattle are of very little value, and it is cheaper to kill and pay for them than to fence the road. Common-law principle is reversed, as you will note, and each man is obliged to fence against his neighbor. This seems a great hardship and inequity to one who is not familiar with it, but the law and its construction is based upon what is believed to be justice to the several classes of population in a territory where there are vast areas of wooded and uncultivated land in which cattle are turned out to feed."

The Chicago, Milwaukee & St. Paul people are making special arrangements for transporting passengers to the various summer conventions. The announcement is made that this company runs two trains daily *via* Omaha to San Francisco, seven through trains daily *via* four different routes, and six trains daily between Chicago and Milwaukee. The trains are vestibuled and lighted by electricity, and an absolute block system of signals protects all the trains on the road.

Pneumatic-Hydraulic Riveters.

The annexed engravings represent two kinds of pneumatic-hydraulic riveters, recently built by Pedrick & Ayer Co., of Philadelphia. That with the vertical cylinders was made for riveting girders employed in the erection of buildings. It works perfectly and is very easily handled. It drives a nest of 5 rivets in a 15-inch I beam in 20 seconds. The work done is reported to be perfect in every particular, as each rivet was thoroughly upset and filled the hole before forming a head. The depth of the gap is 26 inches, width 15 inches. In the enlarged upper ends of this machine are two 10½ x 12-inch air cylinders; the pistons acting on hydraulic cylinders are 1⅝ inches diameter, giving an accumulated pressure on two large plungers, showing behind the hose connection near the upper centers. Their action gives about 30 tons pressure on the rivet dies, having all the good points of a hydraulic riveter without the cumbersome swing joints necessary when hydraulics are used as the primitive power. Light, flexible hose is employed, carrying from 80 to 100 pounds of gage pressure The machine in working order weighs 2,078 pounds.

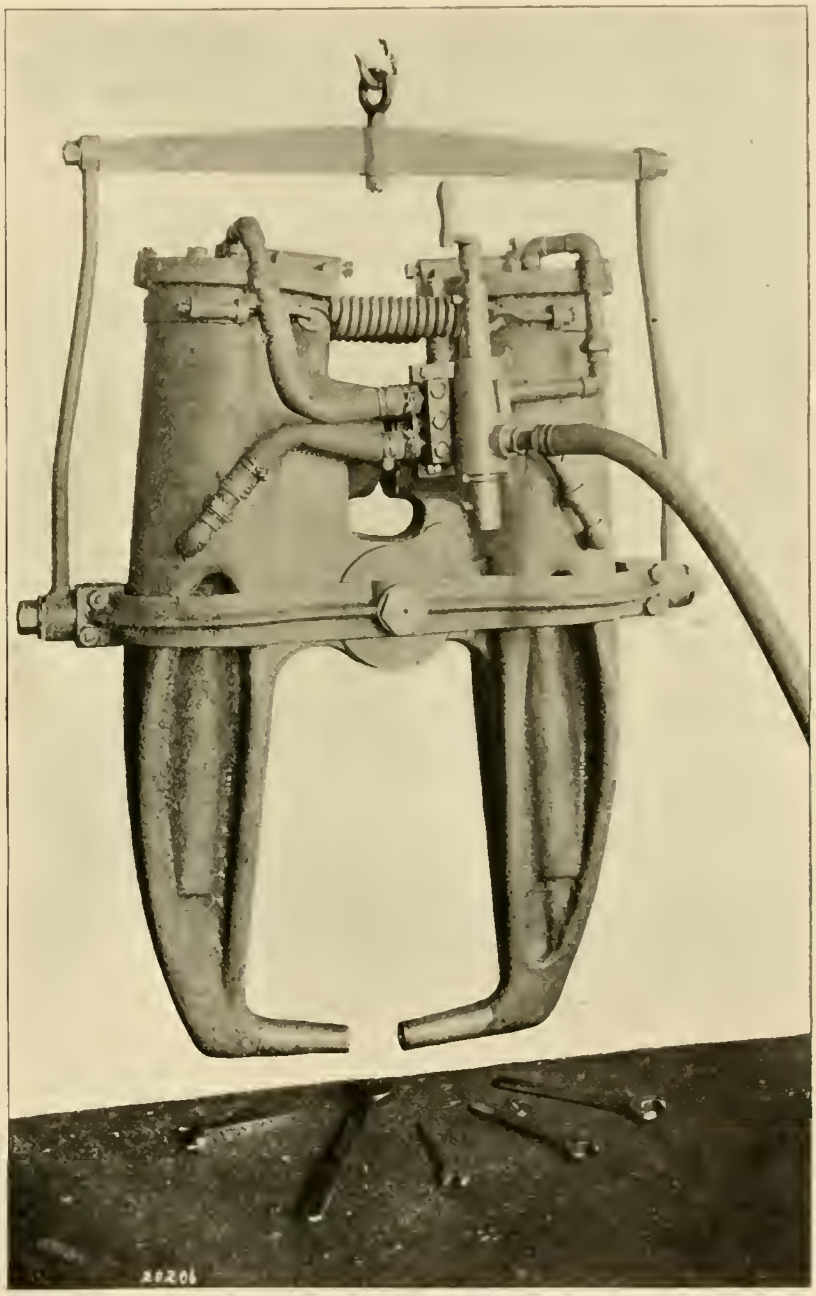


Fig. 1. PNEUMATIC-HYDRAULIC RIVETER.

The small machine (see page 472) weighs 1,163 pounds, and is designed for tank and smokestack work, and will rivet up a stack as small as 10 inches in diameter. The depth of the throat is 50 inches, width 9 inches. The machine is powerful enough to work ½-inch rivets, suitable for steam work, or ⅝-inch rivets for structural work. Both of the machines are very quick acting and do first-class work.

Inaccuracy of Lead Screws.

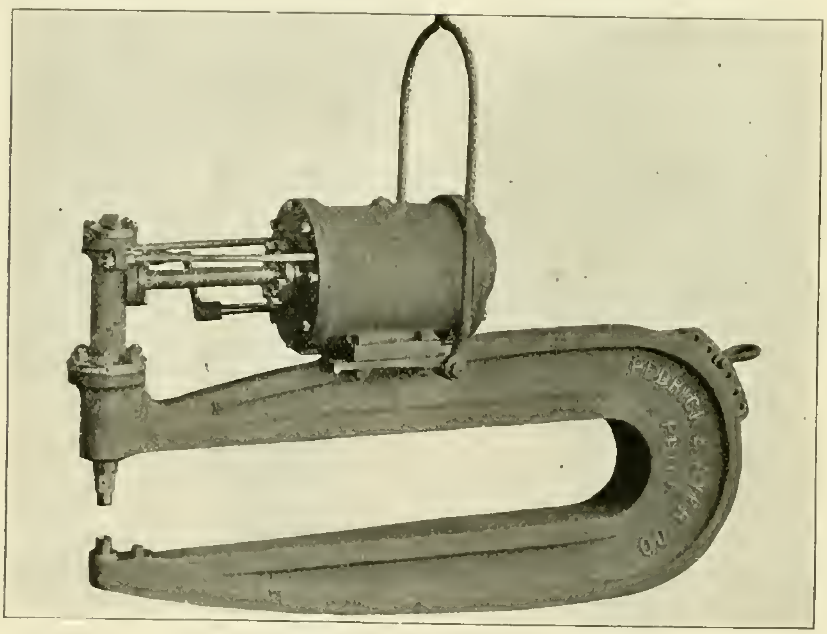
Accuracy in the finish of machine shop production has made remarkable progress since the days when James Watt was in ecstasies at finding that the cylinder of an engine was bored so nearly true that he could not press in a half-crown between piston and cylinder. Yet we still find, occasionally, inaccuracies in parts which ought to be as nearly perfect as possible, and that in the product of shops where tools of precision are employed that ought to reduce errors of measurement to a minimum.

If there is any product of the machine shop more than another which ought to be made as true as possible, it is the lead screw of a lathe. If that screw varies perceptibly from the established standard, it is going to produce bad work in screw cutting, and send forth distorted screws that are likely to make defective fittings wherever they are applied in the construction of a machine.

In tests made of lead screws not long ago, it was found that there are very few lead screws so true as they ought to be. It was found that a half nut only 3 inches long, correctly cut by the aid of the microscope, would ride the thread of an ordinary lathe lead screw of the same supposed and intended pitch. In one instance a lead screw 36 inches long, with a pitch of six threads to the inch, was tested inch by inch, the readings being by five-thousandths of an inch, and every inch showed a falling-off from the true pitch, the minus in the aggregate being 0.027 inch in the 36 inches.

Other lead screws tested showed much greater variation than that one, some of them gaining in pitch in one part, and losing in another a short distance away. When inaccuracies of this kind were found in what were really well-made tools, purchasers might easily imagine what they might expect from inferior tools. A variation from truth of 0.027 inch is not much, but under certain circumstances it is cumulative. If it was used to cut the lead screw for another lathe, and that in turn employed for the same purpose, it would require only a small extension of the process when one thread would be lost altogether.

The machines built by the Chicago Pneumatic Tool Company are meeting with great success in Europe, and to meet the demand they have been compelled to put in six special machines and are running two-thirds of their machinery twenty hours out of twenty-four. They have a standing order to ship twenty hammers and twenty drills each month to one firm in London.



PNEUMATIC-HYDRAULIC RIVETER No. 2.

Owing to a steady increase of business, the offices of the H. W. Johns Manufacturing Company, which have been in Maiden lane, New York, for twenty-five years, have been moved to the ground floor of the new Woodbridge Building at William, John and Platt streets, New York. The new offices are among the handsomest in the country, and greatly increase the facilities for doing business. The basement of the building is used for stock. Among the products handled by this company are: Liquid paints; roofing and other fireproof construction material; heat insulating coverings; coverings for steam pipes, boilers etc.; steam packing; fireproof cements; cloth rope; cord; twine, and numerous other articles, all of which bear the trade-mark of the company, "Asbestos," in peculiar letters, the look of which everybody is familiar with.

Mr. A. O. Norton, of the Norton jack firm, formerly of 336 Congress street, Boston, Mass., has recently moved to 167 Oliver street.

We understand that all the locomotives, with one exception, at the Tennessee Centennial Exposition, have their glands packed with United States metallic packing.

The Dickson Locomotive Works are building a new boiler shop, which will be equipped with all the most modern machinery for the construction of locomotive boilers. It is reported that the company intend putting in considerable number of new tools for locomotive work.

A new press for the San Francisco Examiner was shipped from New York the other day to San Francisco, by way of the Baltimore & Ohio, the Chicago & Northwestern and Union Pacific. The Baltimore & Ohio took it from New York to Chicago in three days, and it reached its destination in the remarkable time of ten days from New York, the distance being 3,406 miles. Ten years ago the average time for such shipments was 30 days.

The Davis & Egan Tool Company, of Cincinnati, report that they find a general improvement of trade in the Northwest, the Chicago house having taken some very good orders lately. This company has just received an order from the Parkersburg Rig & Reel Company, Parkersburg, W. Va., for tools to equip their machine shop. They have also received orders for $30,000 worth of tools from Antwerp, Stockholm and Copenhagen.

There was a curious case before a court in New York lately. In a suit brought against Mr. E. C. Machen, it was claimed that he built the Macon & Northern Railroad with no other capital than one side of bacon and a note for $55. At least a story to that effect is told by a Georgia paper. When Mr. Machen's attention was called by the prosecuting attorney to the somewhat scanty original capitalization of the road, he exhibited more pride than discomfiture and demanded admiration for his exploit, on the ground that while any fool could build a railroad with money, it took a man of brains to make one out of next to nothing.

The Southern Railway express trains are run from Washington to Charlotte, N. C., 380 miles, in 10 hours and 45 minutes, twelve stops being made on the way. The average speed is a little over 35 miles an hour.

Mysterious Defects.

Defects often develop in steam engines and other machines, that are very mysterious in their origin and call for great ingenuity in detecting the cause. Unless a man in charge of an engine develops habits of close observation, he is likely to be easily beaten when anything unusual takes place.

We read lately of a tendency to run away of a Corliss engine, which was a great mystery for a time. The engine would speed up for a few moments without any apparent cause, and drop back to its normal speed without anything being done. The engine was taken apart and examined carefully, and particular attention was devoted to the governor, but nothing wrong could be found. One day, while the engineer was looking at the engine, it suddenly speeded up about fifty revolutions above the normal, and before the steam could be shut off, it dropped back to the regular speed. The engine was stopped, the governor again taken apart, the valve mechanism examined and very minute inspection made over the whole machine, and nothing could be found the matter.

Some of the people about were beginning to think this erratic engine was acting outside of natural laws and that a real mystery surrounded the tendency to run away. By accident, the engineer grasped the governor belt, and was surprised to find that the pulley turned on the shaft. The pulley was of the common kind, made in two pieces and bolted together, being held to the shaft by the friction of the parts. The bolts had worked loose and permitted the pulley to turn on the shaft at short intervals.

When hearing about this mystery, the surprise we experienced was that the engineer did not thoroughly examine that pulley after he had looked at the governor.

A Tree Which Will Not Burn.

A Government report from Colombia contains a description of a tree, known as the chaparro, which is said to possess the quality of being fireproof. It grows on the vast plains of Colombia and the north of South America, called savannas, extensive districts which are parched with heat except during the rainy season.

It has long been the custom to clear the ground for the new vegetation which springs up so luxuriantly on these plains after the rainy season by means of fire—and such fires, miles in extent, kindled by the herdsmen, destroy everything in the shape of vegetation, except the chaparro tree, which survives to afford a welcome shade in an almost treeless region.

It is a small tree, seldom growing to more than twenty feet in height, with a girth of about three feet, and it owes its protection from fire to the nature of its hard, thick bark.

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AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll-Sergeant Drill Co., N. Y. City.
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co., Philadelphia, Pa.
Rand Drill Co., New York.

AIR DRILLING MACHINE.
C. H. Haeseler & Co., Philadelphia, Pa.

AIR LIFT PUMP.
Ingersoll-Sergeant Drill Co., New York.

AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

AIR PUMP GOVERNORS.
Mason Regulator Co., Boston, Mass.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
Carey Mfg. Co., Philip. Lockland, O.
H. W. Johns Mfg. Co., New York.

AXLES.
Cambria Iron Co., Philadelphia, Pa.
Gould Coupler Co., New York.

BALANCED SLIDE VALVES.
Am. Bal. Slide Valve Co., San Francisco, Cal
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
Boston Belting Co., Boston, Mass.
Peerless Rubber Mfg. Co., New York.

BENDING MACHINES.
Bement, Miles & Co., Philadelphia, Pa.
Long & Allstatter Co., Hamilton, O.

BICYCLES.
Pope Mfg. Co., Hartford, Conn.
Armstrong Bros. Tool Co., Chicago, Ill.

BLOW-OFF VALVES.
Crosby Steam Gage & Valve Co., Boston, Mass.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER COVERINGS.
Carey Mfg. Co., Philip. Lockland, O.
Keasbey & Mattison Co., Ambler, Pa.

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Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

BOILER TOOLS.
Richard Dudgeon, New York.

BOILER TUBES, LOCOMOTIVE.
Allison Mfg. Co., Philadelphia, Pa.
Tyler Tube & Pipe Co., New York.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.
Webster & Perks Tool Co., Springfield, O.

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Audel & Co., New York.
Griffin & Winters, Chicago, Ill.
H. C. Baird & Co., Philadelphia, Pa.

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Bement, Miles & Co., Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
The Sargent Co., Chicago, Ill.

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BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BUFFERS, BLOCKS, SPRING.
Gould Coupler Co., Buffalo, N. Y.

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Lima Locomotive & Machine Co., Lima, O.

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Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
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National Malleable Castings Co., Chicago, Ill.

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CAR HEATING HOSE.
N. Y. Belting & Packing Co., New York.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR ROOFING.
Drake & Weirs, Cleveland, O.
Standard Paint Co., New York.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.

CAR WHEELS.
Ramapo Wheel & Foundry Co., Ramapo, N. Y.
Standard Steel Works, Philadelphia, Pa.

CAR WHEEL BORERS.
Manning, Maxwell & Moore, New York.

CASTINGS, STEEL.
Lima Locomotive & Machine Co., Lima, O.
Sargent Co., Chicago, Ill.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHANNELERS.
Ingersoll-Sergeant Drill Co., New York.

CHIME WHISTLES.
Crosby Steam Gage & Valve Co., Boston, Mass.
Star Brass Mfg. Co., Boston, Mass.

CHUCKS.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

COAL CUTTERS.
Ingersoll-Sergeant Drill Co., New York.

COAL HANDLING MACHINERY.
Link Belt Engineering Co., Philadelphia, Pa.

COMPRESSED AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

COMPRESSED AIR TOOLS.
C. H. Haeseler & Co., Philadelphia, Pa.

CONVEYORS.
Link Belt Engineering Co., Philadelphia, Pa.

COUNTERS, ENGINE.
Crosby Steam Gage & Valve Co., Boston, Mass.

COUNTING MACHINES.
Felt & Tarrant Mfg. Co., Chicago, Ill.

CUTTING-OFF MACHINES.
Armstrong Mfg. Co., Bridgeport, Conn.
Newton Mach. Tool Works, Philadelphia, Pa.

CRANES.
Manning, Maxwell & Moore, New York.
Wm. Sellers & Co., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.

CUTTING ATTACHMENT.
Cincinnati Milling Mch. Co., Cincinnati, O.

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BUYERS' FINDING LIST—*Continued.*

CUTTING OFF MACHINES.
Armstrong Mfg. Co., Bridgeport, Conn.

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Lodge & Shipley Mch Tool Co, Cincinnati, O.
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Baldwin Locomotive Works, Philadelphia, Pa.

ELECTRIC SUPPLIES.
General Electric Co., New York.

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W F. & John Barnes Co., Rockford, Ill.

EMERY WHEELS.
Diamond Machine Co., Providence, R. I.

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Nicholson File Co., Providence, R. I.

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Stow Flexible Shaft Co., Philadelphia, Pa.

FLEXIBLE STEAM JOINT.
Moran Flexible Steam Joint Co., Louisville, Ky.

FLUES, IRON.
Tyler Tube & Pipe Co., Washington, Pa.

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FORGINGS.
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Richard Dudgeon, New York.
Long & Allstatter Co., Hamilton, O.
Williams, White & Co., Moline, Ill

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BUYERS' FINDING LIST *(continued).*

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BUYERS' FINDING LIST—*Continued.*

MILLING MACHINES.
Bement, Miles & Co., Philadelphia, Pa.
Cincinnati Milling Mch. Co., Cincinnati, O.
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Niles Tool Works Co., Hamilton, O.
Pedrick & Ayer Co., Philadelphia, Pa.
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Crosby Steam Gage & Valve Co., Boston Mass.
Star Brass Mfg. Co., Boston, Mass.

PORTABLE CRANK PIN MACHINES.
Pedrick & Ayer Co., Philadelphia, Pa.

PRESSES, HYDRAULIC.
Bement, Miles & Co., Philadelphia, Pa.
Watson & Stillman Co., New York.

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ESTABLISHED 1884.

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Galena Oils are in exclusive use upon three continuous lines from Boston and New York to the Pacific coast, and upon one continuous line from the City of Mexico to New York, thus demonstrating their adaptability to all temperatures and climates. Being entirely free from gum, these oils are not affected by dust and sand as other oils are.

We also furnish our customers SIBLEY'S PERFECTION VALVE OIL, which is also used exclusively upon a majority of the leading railways of America.

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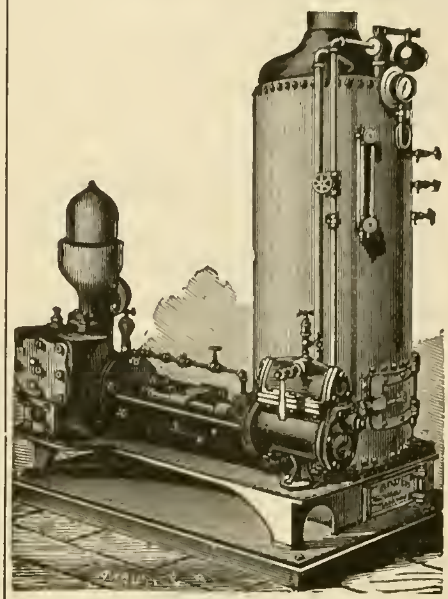

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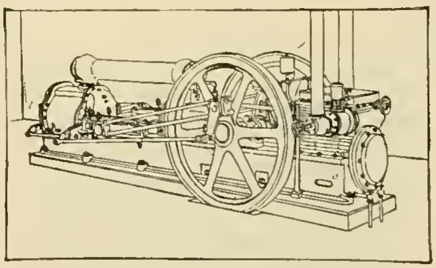

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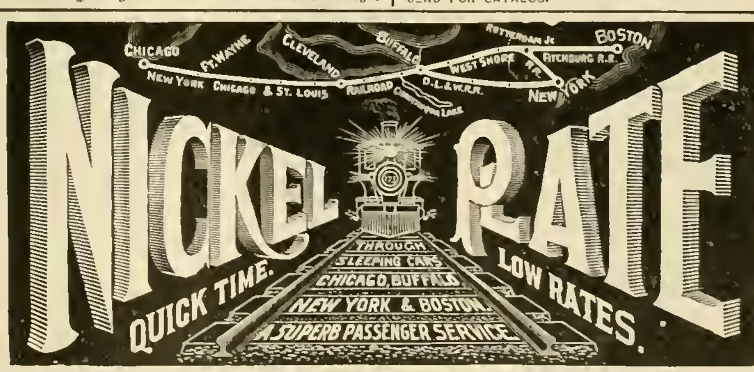

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(*Continued on page 482.*)

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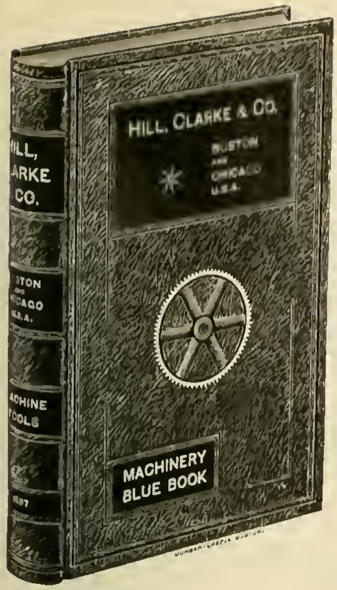

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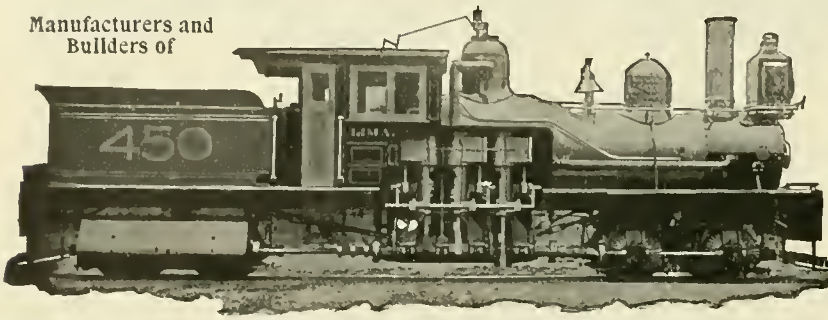

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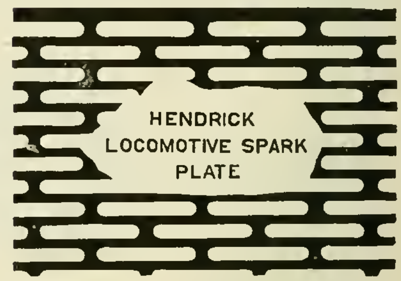

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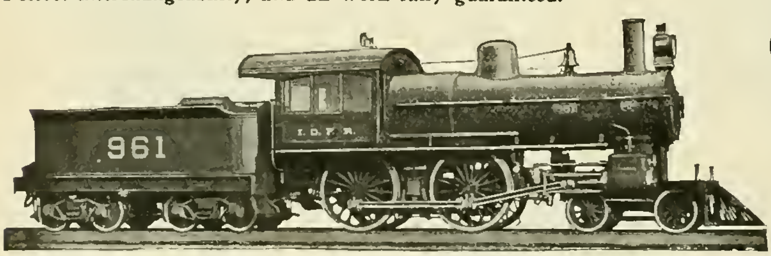

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For sanding the track instantly when brake is applied, and by sand blast in starting or hand blast only.

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Built in two styles. Four sizes.
Mechanically correct. Thoroughly automatic.
Threads every bolt and stud, from first to last, to the required size.
Changes from one size to another may be made by stopping only the spindle on which same may be desired.
Most simple arrangement for any kind of special tapping and threading.
Largest capacity of any machine of its size.
Write for circular and prices.

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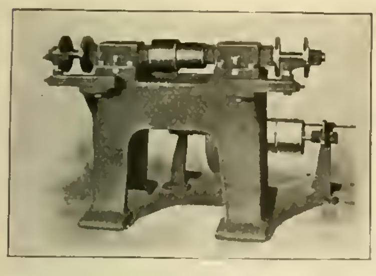

Adapted to Light and Heavy Grinding.

Has Self-Oiling Bearings.

Perfectly Dust-Proof and Fitted with Oil Guards.

Weight, with Countershaft, 1150 lbs.

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How it is Liked.

LEHIGH VALLEY RAILROAD.

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NEW YORK BELTING AND PACKING CO.,
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GENTLEMEN :

About April 25th, we received two new coaches from the Pullman Company, that have your rubber tiling in the smoking rooms, and we are so well pleased with it, that we think of using it for the smoking rooms of five more coaches of the same design as the two referred to.

If this is done, we would want the tiling placed in one coach at a time, the work to be done at South Easton Shop, and the amount of tiling required per car would be just the same as in the case of the two cars built at Pullman. . . . .

A prompt reply will oblige,

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PIONEERS AND LEADERS, 25 PARK PLACE.

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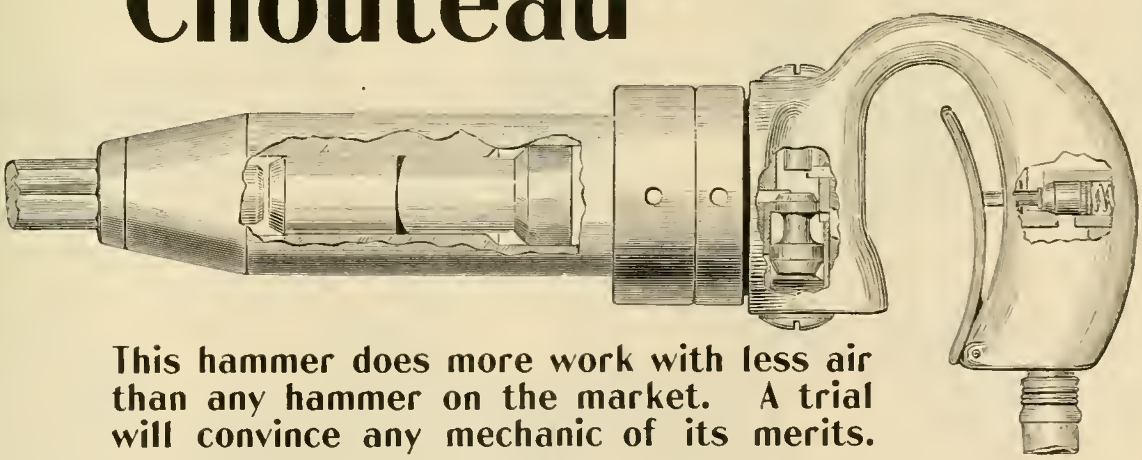

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This hammer does more work with less air than any hammer on the market. A trial will convince any mechanic of its merits.

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Metallic Piston Rod and Valve Stem Packing. Gollmar Locomotive Bell Ringer. Dean Pneumatic Sander. Portable Pneumatic Drills.

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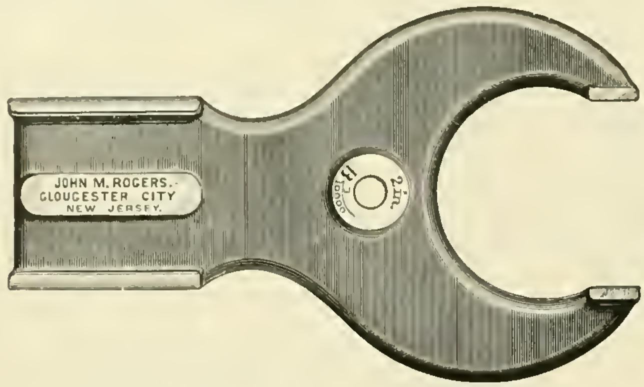

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"Accuracy."

There are two ways of doing things, the right way and another.

The right way is to use Rogers Tools where your desire is for the best of work.

Where you don't care, another way will do. It shouldn't take long to decide.

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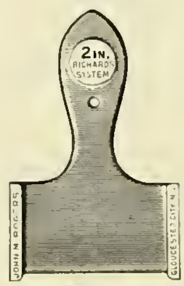

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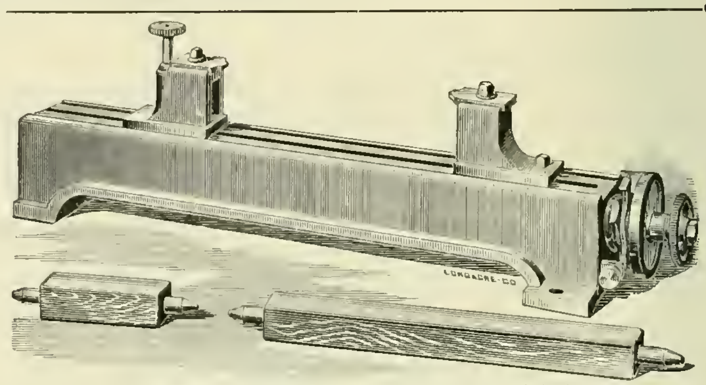
These Tools have been in use for years, and improved from time to time.

There are a great many first-class artisans using these tools exclusively.

The why and wherefore await your address. Right now is a good time to write.

"Precision."



Measuring Machines, 0 to 4", 12", and 24"

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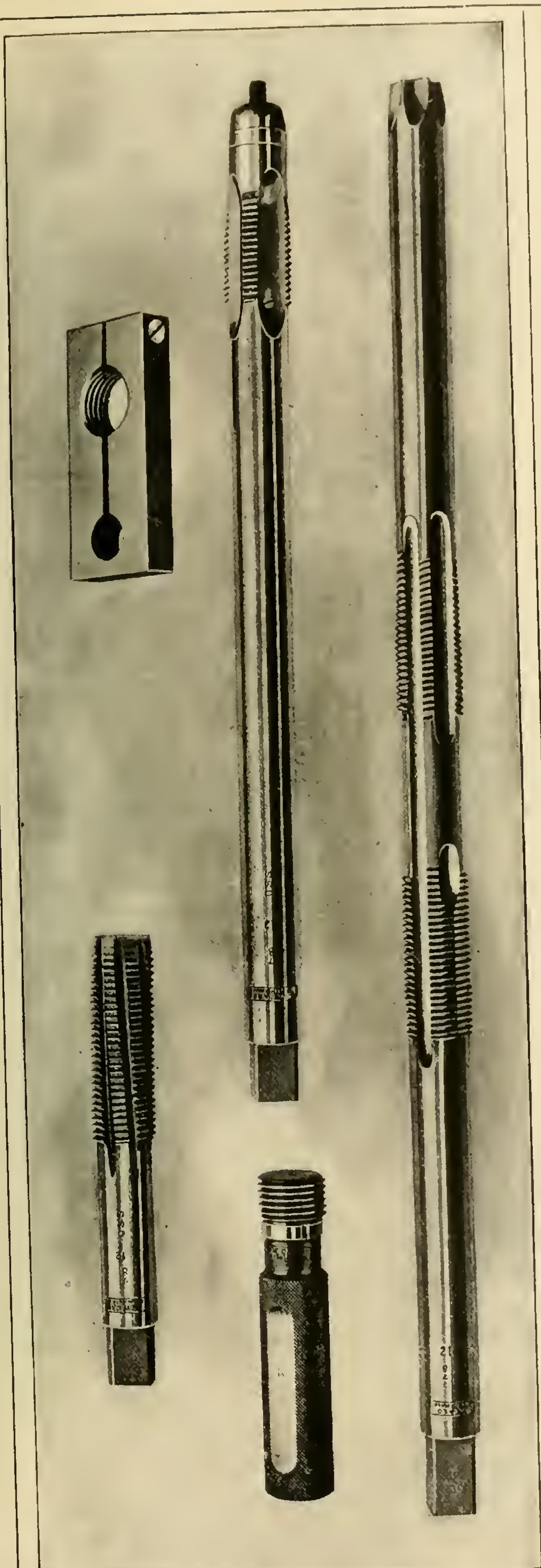

"The World's Rail Way."

The handsomest and finest book ever issued—no exceptions. LOCOMOTIVE ENGINEERING has control of the whole number (1,000), and you have a chance to get one. These books cost, to make, over $16 each; we are going to sell them at $7.50 each—you to pay express charges. This is the only edition printed or to be printed—each copy will increase in value with time.

How we can do it for $7.50

The B. & O. road had a fine exhibit of originals and models of early locomotives at the World's Fair, which afterward formed the nucleus of the Field Railway Museum at Chicago. The world renowned artist and engraver, Mr. E. E. Winchell, made the pictures of early locomotives and cars that formed a large part of that exhibit.

After the Fair, Major Pangborn, who got together the B. & O. exhibit, commenced to write a history of the development of the rail way. As the work grew and interest was taken, thousands of letters and drawings passed back and forth throughout the world, to contribute to the accuracy of the work. Families of illustrious inventors and promoters brought out their treasures of old pictures, letters and historical data, and from this great mass of interesting material Major Pangborn gleaned the facts and wrote his book. Then the directors of the Field Museum sent a commission around the world to gather facts and figures, data, etc. Major Pangborn headed that commission, and Mr. Winchell was its artist; all the information secured was used to correct and verify the work.

Being the originators of the work, the officials of the B. & O. ordered an edition of 1,000 of these books, intending to distribute them to the leading railroad men of the world.

It takes a long time to get out such a book—178 11 x 14 pages, with upward of 300 illustrations, 154 of these being in three colors—and before the job was completed the B. & O. was in the hands of a receiver, and the artist and the printer had $16,000 worth of work on their hands. Then the printer went into the hands of a receiver.

An edition de luxe of 150 copies was printed on Japan hand-made paper, and sold on sight for $25 each. The writer has one that he paid that for, and $100 wouldn't buy it, if another could not be had.

THE 1,000 COPIES ARE PRINTED ON THE FINEST PLATE PAPER, LEATHER COVERED, ROUGH EDGES, GILT TOP—JUST LIKE THE EDITION DE LUXE, EXCEPT PAPER.

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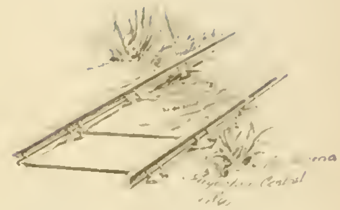
Locomotive Engineering,

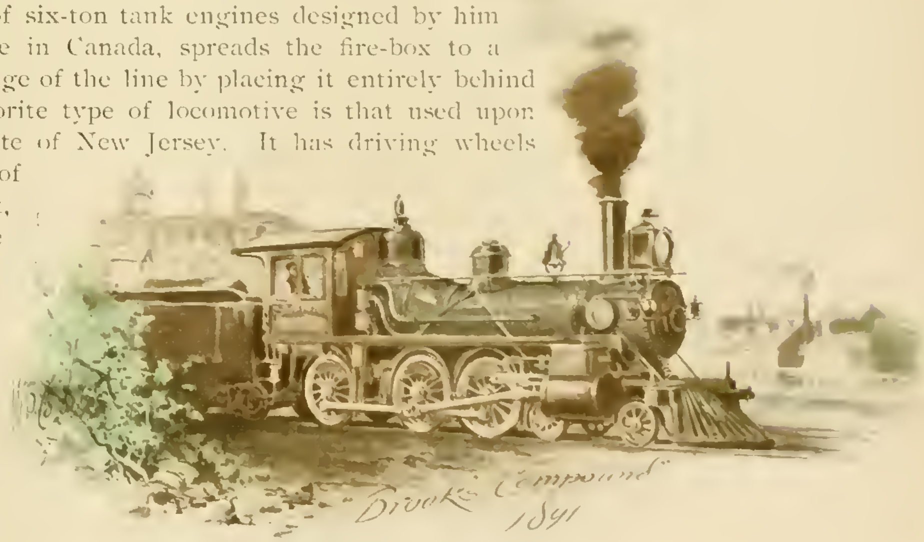
256 Broadway, New York.

Sample Pages Opposite.
Paper is much Heavier.

by the engineer, the fireman's place being at the other end. On a temporary line built over one of the tunnels that is in progress, Winans successfully works a nineteen-inch eight-coupled locomotive, which regularly ascends an incline slightly steeper than one in ten, or five hundred and thirty feet to the mile, drawing behind it the tender and an eight-wheeled loaded car weighing thirteen tons. The weight of the engine is twenty-four and one-half tons, and when the coupled wheels are upon the incline of one in ten only nine-tenths of this weight, or say twenty-one and three-quarter tons, press effectively upon the rails. The tender weighs twelve and three-quarter tons, and thus the aggregate of the whole train reaches fifty tons. Seth Wilmarth has built for the Cumberland Valley Railroad two engines with cylinders twelve and one-half inches in diameter, a sixteen-inch stroke, and four cast-iron wheels with chilled rims three and one-half feet in diameter, located sixteen feet six inches from center to center. Passenger engines with cylinders sixteen and one-half inches in diameter, a twenty-two-inch stroke, and four coupled wheels seven feet in diameter are the class most favored on the Hudson River Railroad. The sensational locomotive of the year is Millholland's "Illinois" on the Reading Road, it being the initial passenger engine on that line to burn anthracite coal, and the first really successful consumer of such fuel running into Philadelphia. This engine has two pair of seven-foot driving wheels, and has attained a speed of seventy-five miles an hour. She was built in the Reading shops, and has cylinders seventeen inches in diameter, with a stroke of thirty inches. The slide valve is double, with one plate at either end of the cylinder, while the link motion is operated by return cranks outside of the side rods. Her weight is sixty-two thousand pounds. Up to this time Chicago has not had a complete and uninterrupted line of railroad to the Eastern cities, but the Michigan Central is now open, and by connecting with the Lake Shore lines and the New York and Erie, there is a through all-rail route from the Atlantic to Lake Michigan. The entire line of the Central Railroad of New Jersey, which is made up of a number of smaller corporations, has been completed and opened under a single management. The Pennsylvania Railroad from Philadelphia to Pittsburg is virtually finished, although it has not as yet been formally established as a through route.

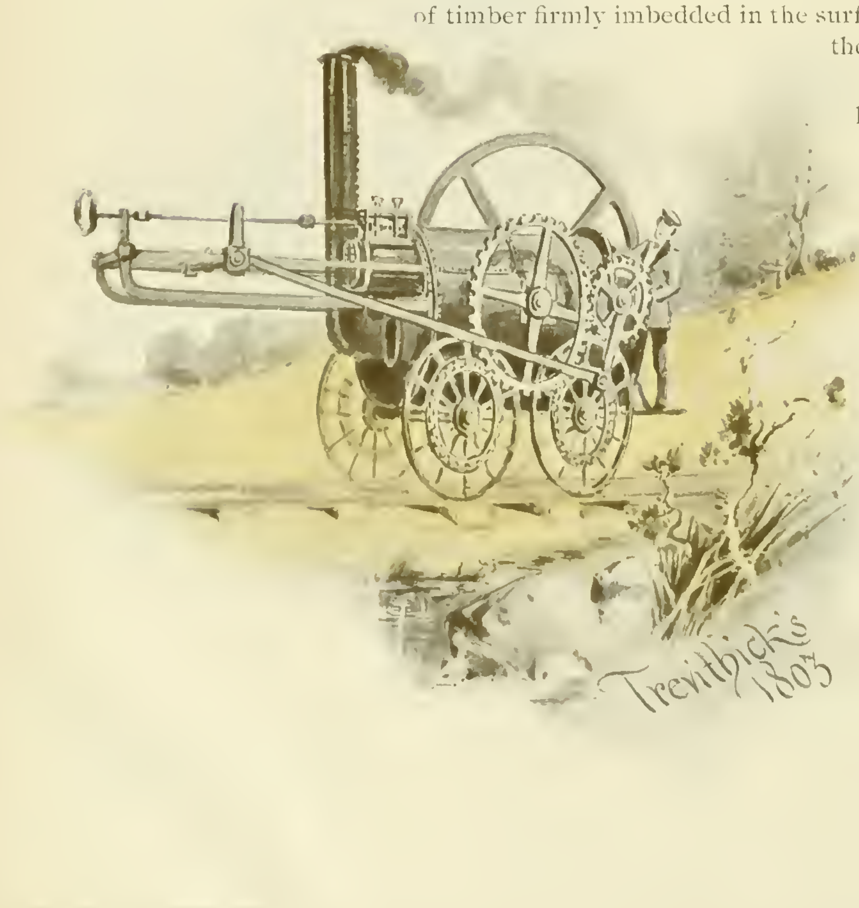


Zerah Colburn, in a number of six-ton tank engines designed by him for the three-feet-three-inch gauge in Canada, spreads the fire-box to a width greater than that of the gauge of the line by placing it entirely behind the wheels. In Germany the favorite type of locomotive is that used upon the railroads generally in the State of New Jersey. It has driving wheels behind the fire-box and two pair of forward wheels in a pivoted truck, permitting the passage of the engine around curves of small radius, an



just in front of these wheels are two horizontal cylinders, one on each side of the engine. Piston rods from the cylinders reach backward, and the connection to the wheel is very novel and ingenious. The inside hub of each wheel has ratchet teeth formed on it for one-half its diameter; into these teeth work corresponding ones on horizontal racks, one above the hub and one below. When the piston moves toward the back end of the cylinder the upper rack engages the hub teeth and revolves the wheels forward, and when the return stroke is made the lower rack engages the hub teeth and continues the revolution. Steam pipes enter each cylinder head, front and back, near the inside and exhaust pipes on the opposite or outside of the heads. There are two steam valves and two exhaust valves to each cylinder, operated by an attachment to the racks, the exhaust being into the atmosphere. Each cylinder has its steam pipe from the boiler provided with a stop cock, and one cylinder or both can be worked at the same time. This is the pioneer conception of the propulsion by steam on land in America, and Read, soon finding it anything but encouraging to secure the necessary funds for construction, stops at the model and turns his attention to other inventions, of which he is remarkably prolific.

Chairs for rails appear in 1792; the mode practiced in fastening them to the blocks is to cast a circular hole on each side of the base of the chair and a hole of similar size is drilled into the block. An oak plug is then driven through both, which, having a wedge-shaped head, and being dry when driven, secures the chair to the sleeper. The chairs have a flat base four by seven inches, and three-quarters of an inch thick, the upper surface upon which the rail rests being also flat and horizontal. Two bosses are cast on the base, with a distance between them equal to the thickness of the web, forming a pocket into which the ends of the rails are inserted. The pins that are driven through the holes into the chairs and rails fasten the ends of the rails to the bosses of the chairs, and prevent their ends from starting upward out of the recess, and the sides, or cheeks, of the bosses prevent the ends of the rail from moving laterally. Stone supports, one foot or thereabouts square and eight inches deep, or square pieces of timber firmly imbedded in the surface of the road, form the sleepers on which the chairs rest when in position.



Evans within the next two years completes, for forwarding to England, the special drawings and specifications of his steam engines and in the Fall of 1794 they are taken across the Atlantic by Mr. Joseph Stacy Sampson for the inspection of English engineers and others engaged in developing steam into an agency of widespread usefulness. James Watt at

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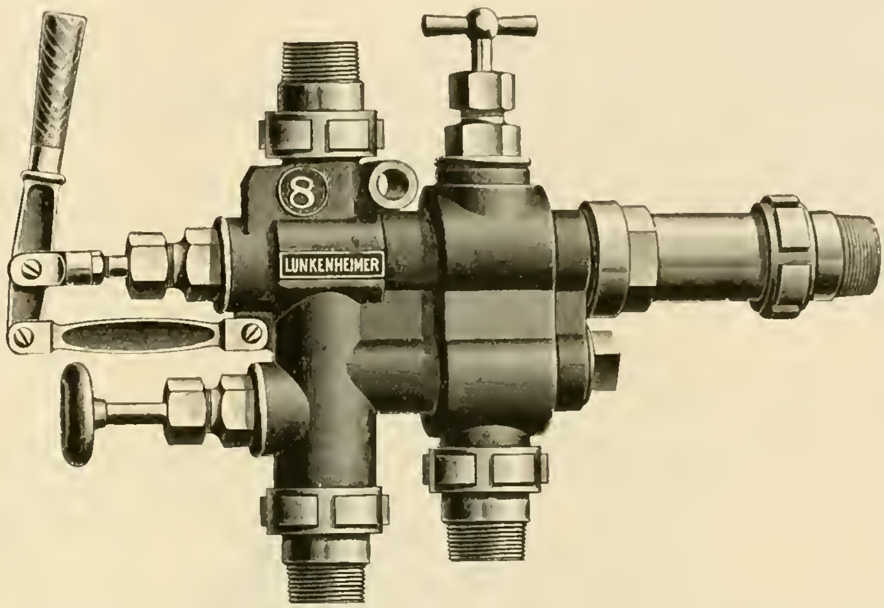

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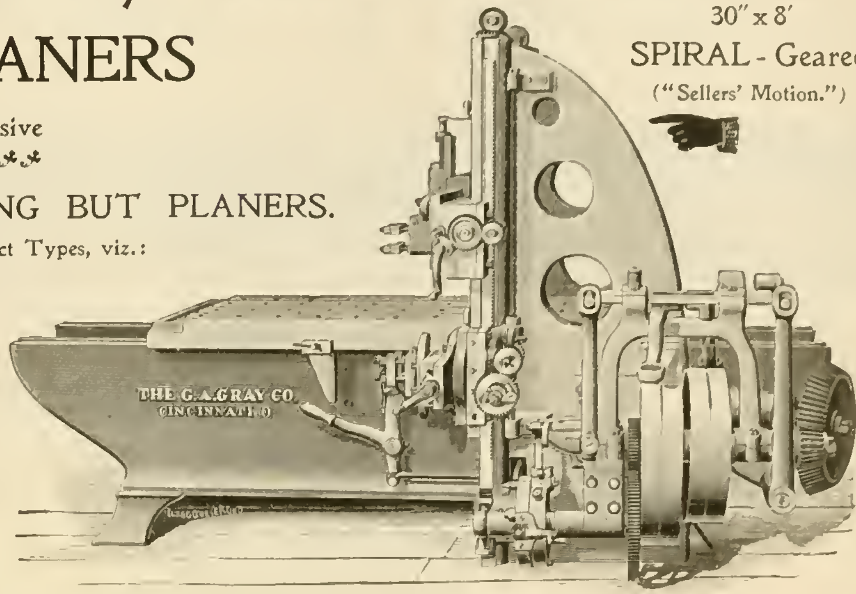

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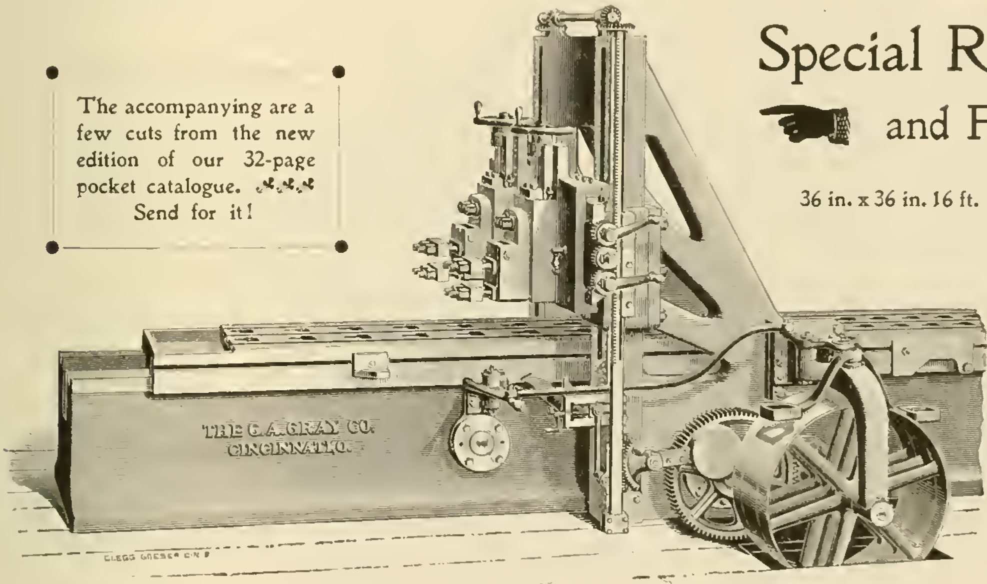

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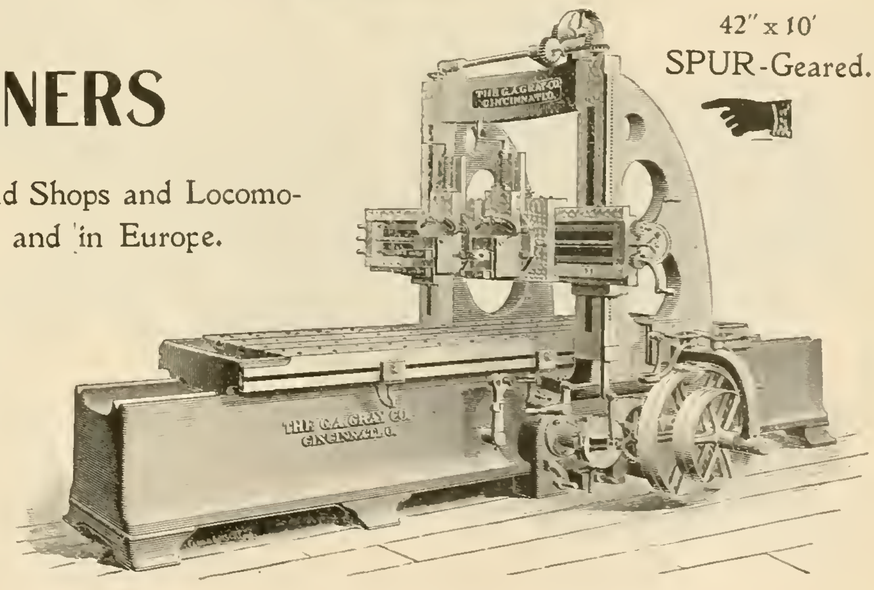

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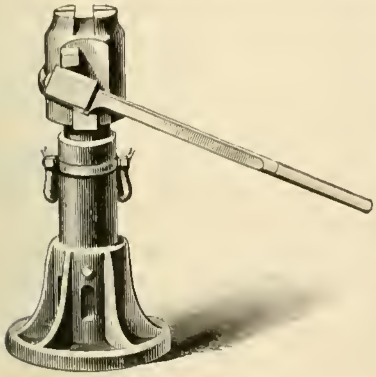

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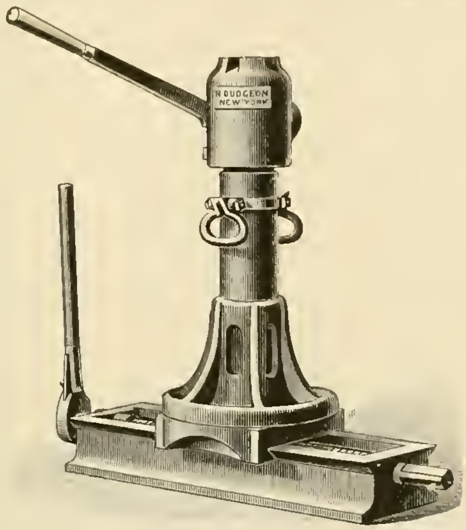

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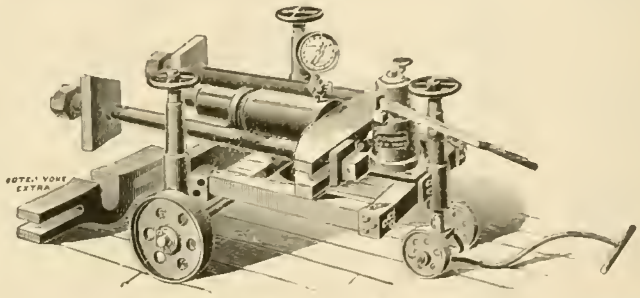

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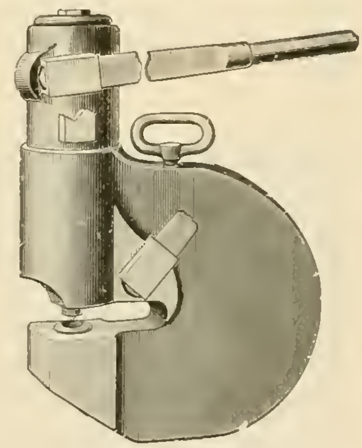

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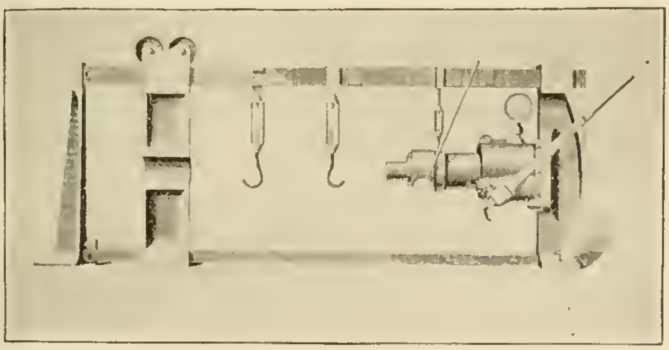

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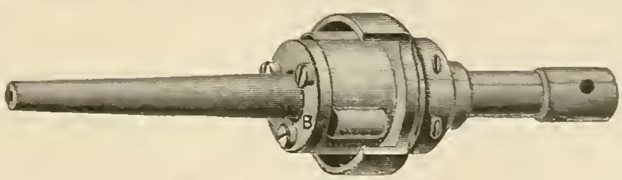

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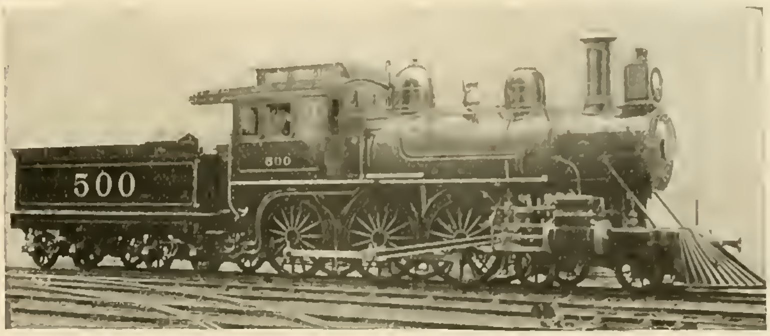
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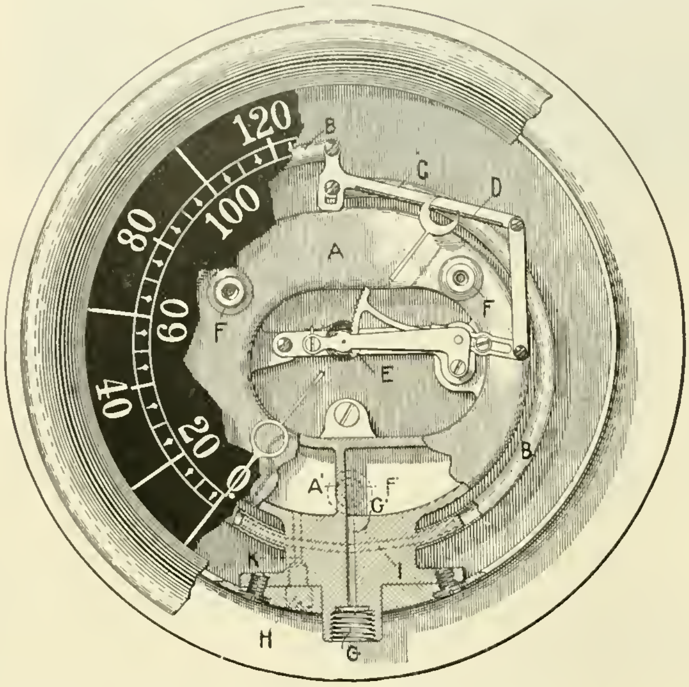

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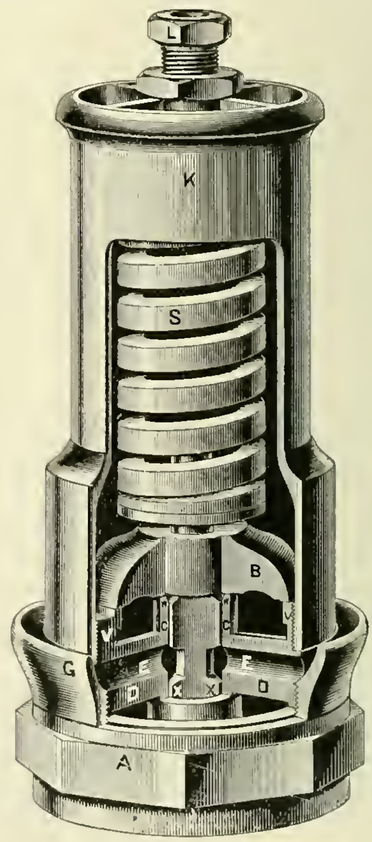

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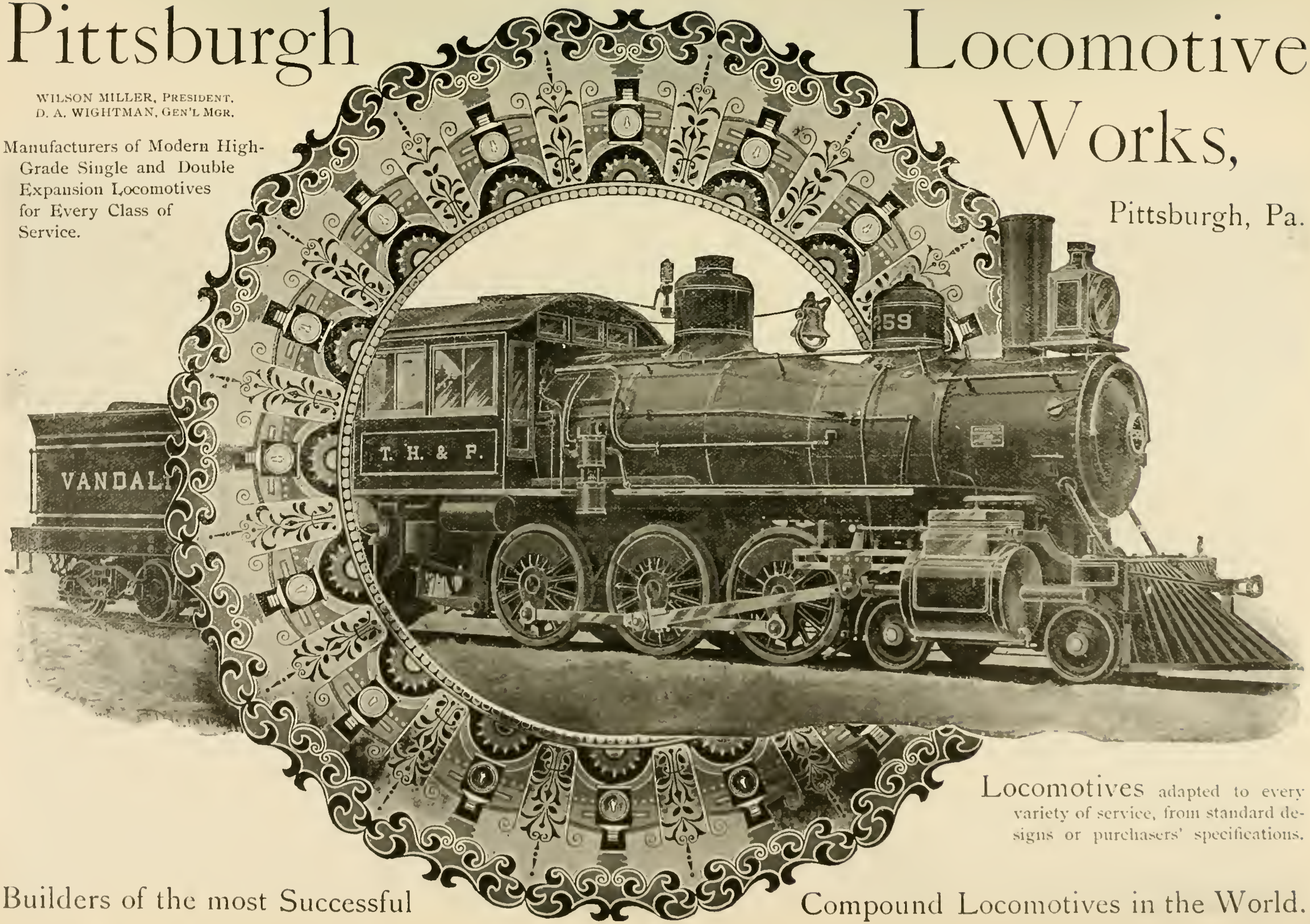

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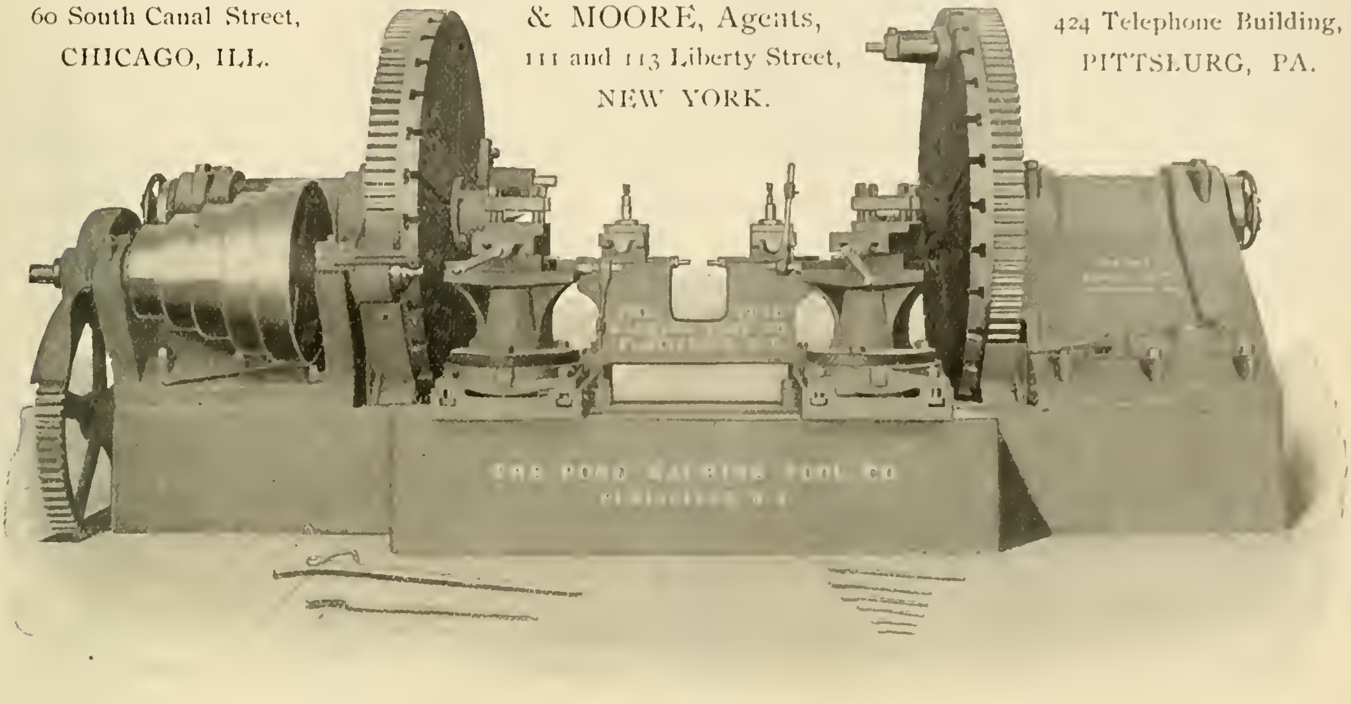

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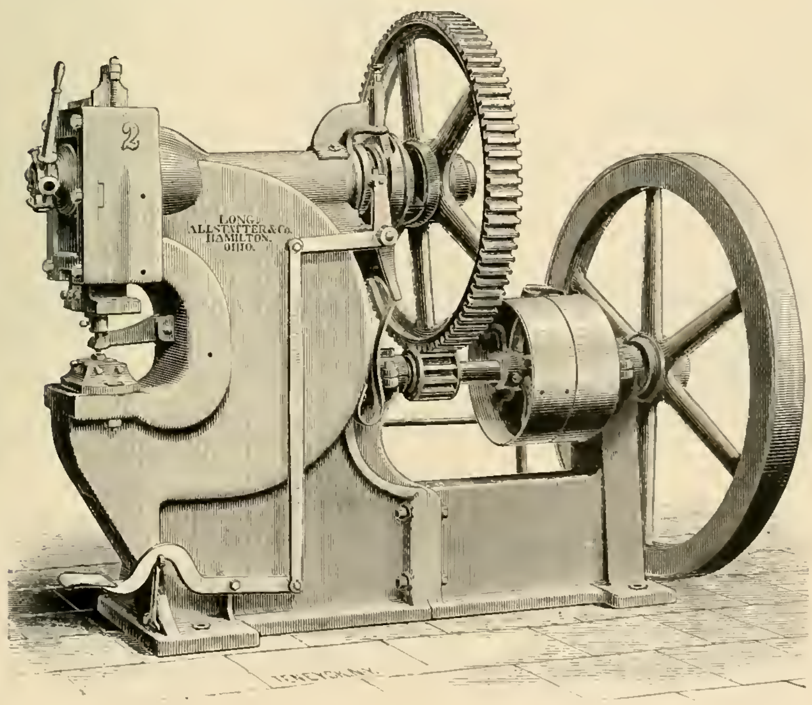

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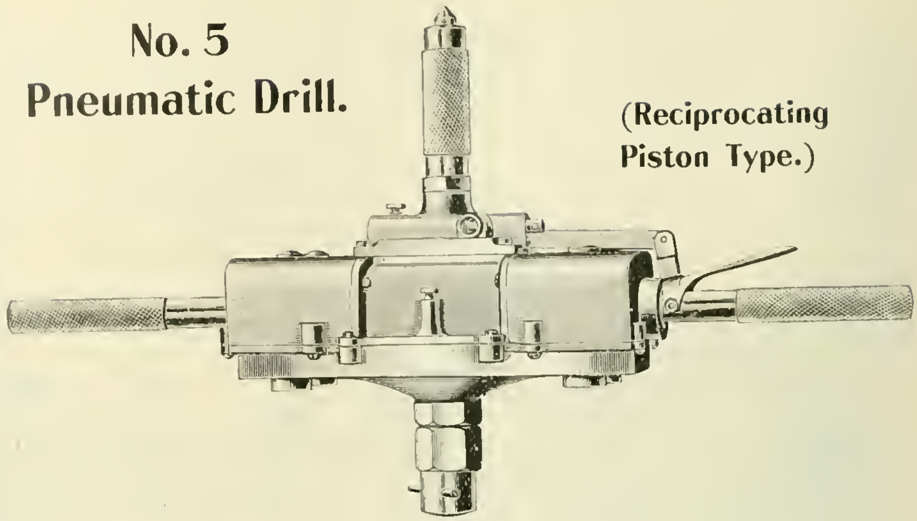

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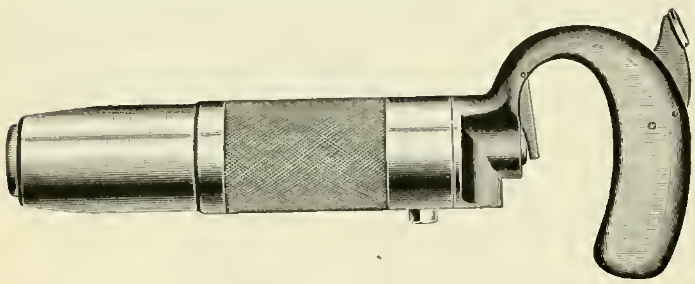

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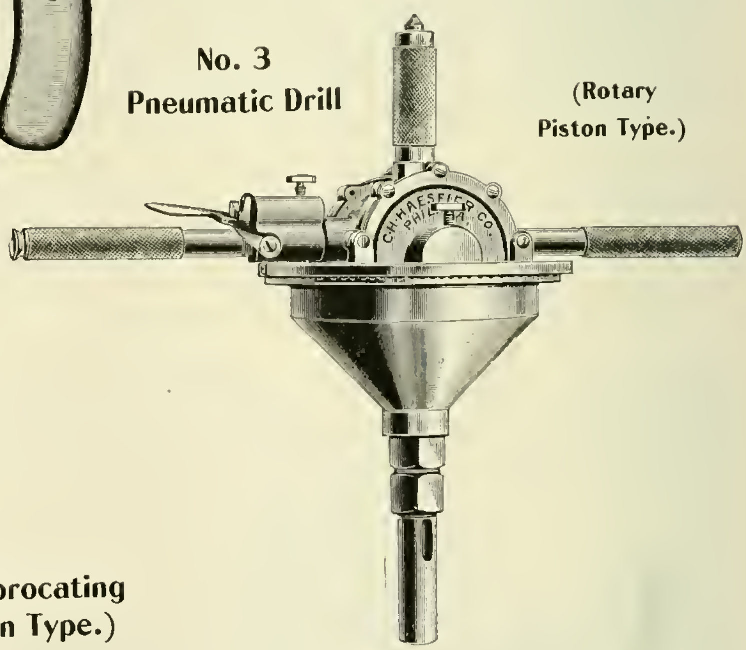

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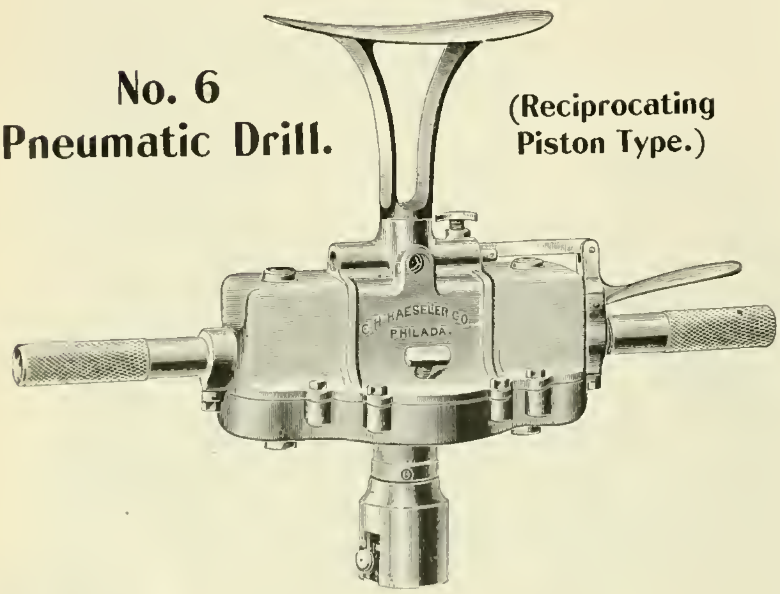
(Reciprocating
Piston Type.)



C. H. Haeseler Co.

Manufacturers,

1026-1030 Hamilton Street,

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All Tools and Appliances pertaining to Pneumatic Equipment.

In use on 245 railroads in the United States and every railroad in Europe.

Sent on 10 days' trial, subject to approval.

Guaranteed for one year against repairs.

For Men Only!

And only for those that wear the pants. I am making custom pants of first-class all-wool goods, good enough for a bridegroom and strong enough for a baseball umpire. They are made to your measure and they only cost you $4.00 per pair. You try one pair and you will be my steady customer. Samples of goods, tape line and measuring blanks free. I have a country shop and a city cutter — hence the price.

The "Brotherhood" Overclothes are known from sunrise to sunset. See that you get the patent safety watch-pocket and the button with "Brotherhood" on it and you will have no regrets.

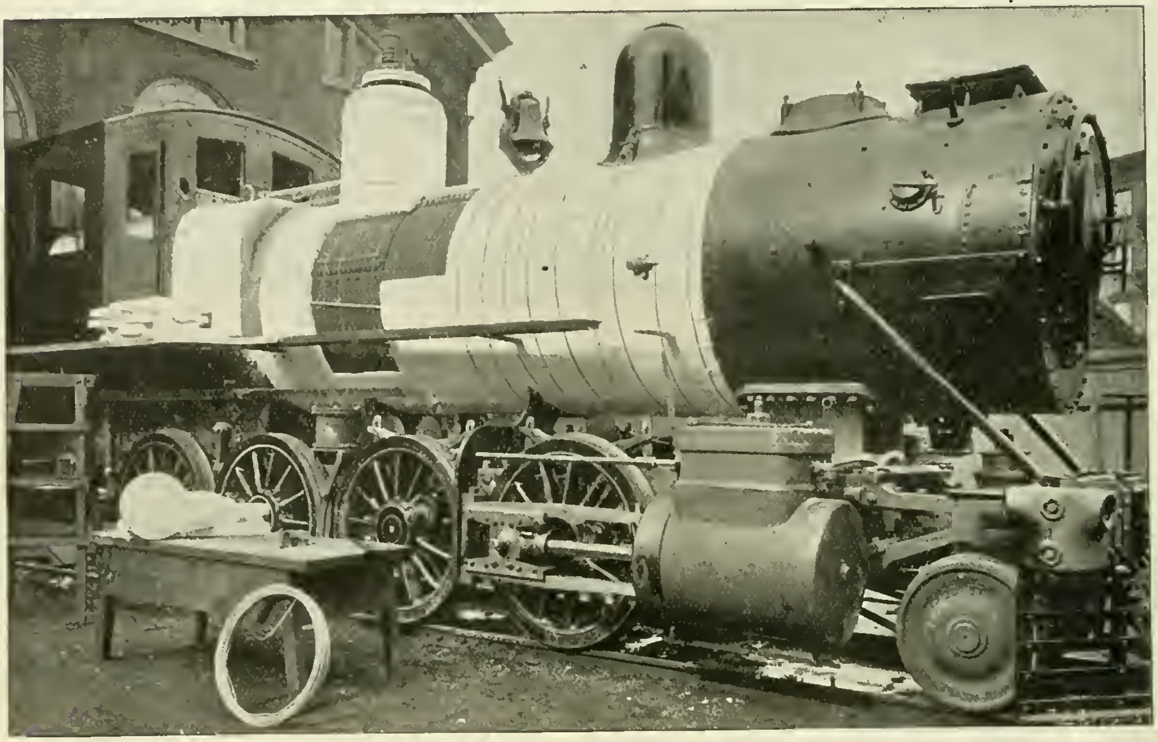
BROTHERHOOD

H. S. Peters,

Dover, N. J.

Keasbey & Mattison Company's

Magnesia Laggings.



ILLUSTRATING THE APPROVED APPLICATION OF MAGNESIA SECTIONAL LOCOMOTIVE LAGGING TO A LOCOMOTIVE AT THE P. R. R. SHOPS, ALTOONA, PA.

From Circular No. 32. March, 1897.

Boston Mutual Manufacturers Insurance Company.

9. March 11. Benedict & Burnham Mfg. Co., Brass Works, Waterbury, Conn.

During the forenoon the wooden lagging on the high pressure cylinder of the engine at the wire mill was found to be on fire, having been ignited by the heat of the cylinder. The fire was immediately extinguished, the loss being confined to the lagging on the cylinder. This wooden lagging was replaced with metal. No claim made.

In connection with this fire might well be mentioned a similar fire which occurred March 2d on a locomotive belonging to the Boston & Maine Railroad. The locomotive was attached to the afternoon express, which arrives in Lowell from the north at 4 P. M. The wooden lagging which surrounds the boiler, and which in turn is covered by Russia iron, was found to be on fire. The train was detained at Lowell long enough to remove some of the plates and extinguish the fire by the use of small hose.

We understand that the packing under this wooden lagging was asbestos, as is the case generally. It is also the custom to place asbestos underneath the wooden lagging on the cylinders of the stationary engines. In time this asbestos becomes so closely packed as to be of little use as a non-conductor of heat. It would be well to remember that the value of asbestos as a non-conductor of heat depends wholly on the air which may be entrapped by the layers of the same.

Did any one ever hear of an engine delayed for such a cause when Keasbey & Mattison Company's

Magnesia Sectional Laggings

was used? No loss of time. No cutting loose from the train and running to the nearest water tank. No repairs. None of the expense which makes the apparently cheap wooden lagging in the end so very expensive, as all progressive railroad men know.

Read what Mr. F. B. Smith, the well-known General Master Mechanic of the N. Y., N. H. & H. R. R., said at a recent meeting of the New England Railroad Club, regarding wooden lagging: "Mr. President, I have had some experience with that, and I think it is a very poor article to be used for a lagging for a boiler jacket. I have seen wooden lagging applied, and inside of three months have had occasion to open the jacket, and there was nothing but charred wood remaining. Where an engine has a hard service—where the mileage is great—**wooden lagging is not worth putting on; that is, it is expensive—it is not economical.** It is very expensive in the long run, and it does not do the duty that it is put on there for. Possibly for the first month out of the shop it might do all it is intended for, but after that I think it is worthless. For myself, personally, as far as wooden lagging is concerned, **I would not allow it to go onto a boiler under any consideration.**"

For estimates for the cheapest and best locomotive lagging known, *Magnesia Locomotive Lagging*, send your Blue Prints to

KEASBEY & MATTISON COMPANY,
Successors to THE MAGNESIA SECTIONAL COVERING CO.
AMBLER, PENNA.

LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. X. NEW YORK, JULY, 1897. No. 7.

The "Big Four's" Fast Run.

Some time ago we made mention of a particularly fast run over the Cleveland, Columbus, Cincinnati & St. Louis, and now, through the kindness of Mr. Theo. C. Becke, of St. Louis, we are able to show an illustration of the engine that made the fastest run, taken from a photograph which he sent us.

BIG FOUR RECORD BREAKER.

The train carried the Geisha Opera Company, and consisted of five cars, weighing 351,000 pounds, exclusive of passengers and baggage. Eight-wheel engines, with cylinders 18½ x 24 inches, driving wheels 68 inches diameter, and boiler giving 1,725.6 square feet of heating surface, pulled the train from St. Louis to Indianapolis, a distance of 262 miles. The run from Indianapolis to Cleveland, 283 miles, was made by eight-wheel engines having cylinders 18 x 24 inches, driving wheels 62 inches diameter, and 1,600 square feet of heating surface.

The entire run of 545 miles was covered in 11 hours 18 minutes. With delays in actual stops deducted, the time used in running was 9 hours 55 minutes. From that it will be seen that the 545 miles were run in 595 minutes, an average of 55.38 miles per hour.

The greatest speed was attained between Mitchell and Comstock, on St. Louis division, 3 2-10 miles in 2¾ minutes, or 76.3 miles per hour; Gays to Mattoon, 12 miles in 10 minutes, or 72 miles per hour. On Cleveland division—March's to La Rue, 3 7-10 miles in 3 minutes, or 74 miles per hour; Wellington to Grafton, 11 1-5 miles in 9½ minutes, or 69.7 miles per hour. The engine shown performed this unusual high-speed feat.

A locomotive recently built for the Balanced Locomotive and Engineering Company, of New York, after the designs of Mr. Geo. S. Strong, has been put in the mechanical laboratory of Purdue University, for the purpose of being thoroughly tested. It is a 4-cylinder compound, 2 cylinders being inside frames and 2 outside. The engine has a great many peculiarities which may be improvements.

Boilers Taking Care of Themselves—How to Wash-Out Boilers.

BY HENRY J. RAPS.*

In these days of heavy trains, high speed and long runs, the locomotive boiler is a very important factor in railroad economy. No matter how good the engine may be, its efficiency is decreased to a great extent by a leaky boiler, and if the engine is in poor condition and pounding all over, a good tight boiler is the more necessary. As there is no question about this, let us see how we may keep the boiler in a safe, serviceable condition and in the highest state of efficiency at the least expense.

Let us take for our subject the common type of locomotive boiler with either a deep, short box or a long, shallow one—either crown-bar or radial stayed.

We will take up, first, its proper care and inspection while in service; next, how not to make heavy repairs; then, how to make both light and heavy repairs; and, finally, its disposition when unfit for further service on the road.

We will suppose the boiler is a new one, just from the builder, perfect as can be in design, material and construction, with steel firebox and shell, thoroughly braced throughout. We will also take it for granted that the water the boiler is to use contains carbonates and sulphates of lime, salt, alkali and other incrusting and corroding matter.

Now, don't say to yourself, "I will have a little comfort with that boiler; it will take care of itself for a long time." If you do, you never made a worse mistake. Do you know what it will cost a railroad company to have one hundred such boilers to take care of themselves for one year? It will cost from $10,000 to $15,000. Do you think the figure is too high? It is not a cent too high—not high enough. That boiler is taking care of itself, and as a natural consequence in five or six months it is bound to spring leaks, and the merchant complains because his car of goods had to be set out; the stockmen complain because they wanted to get all of their stock into market by the next morning, but a part had to be left up the road on account of boiler leaking, or they were late to market because hills had to be doubled or the engineer had to run for water; and if a contract was made with the railroad company to get the stock to market at a specified time, there is a chance for damages. Passengers complain because the engine must be held at every station to raise steam, and the chances are they will miss connections.

Do you suppose these people will patronize such a road if they can get better service elsewhere? Not by any means. And this loss will be another big item to add to the amount it costs to have that boiler take care of itself. But this does not include all the expense. There is the extra amount of oil while doubling hills and running for water, the wear and tear of track, tires and machinery, to say nothing of the overtime of engine and train crews. All these items, and others not mentioned, help to swell the amount it costs to have a locomotive boiler take care of itself.

The railroad officials will inquire from you why this engine is making such a bad record. They supposed she was the best engine they had. She is nearly new. You will probably tell them that you can't account for it; it must be the bad water, or faulty construction, or the engineer has abused her.

It's not so. Don't you know that this is the engine that is taking care of herself, and isn't she doing it with a vengeance?

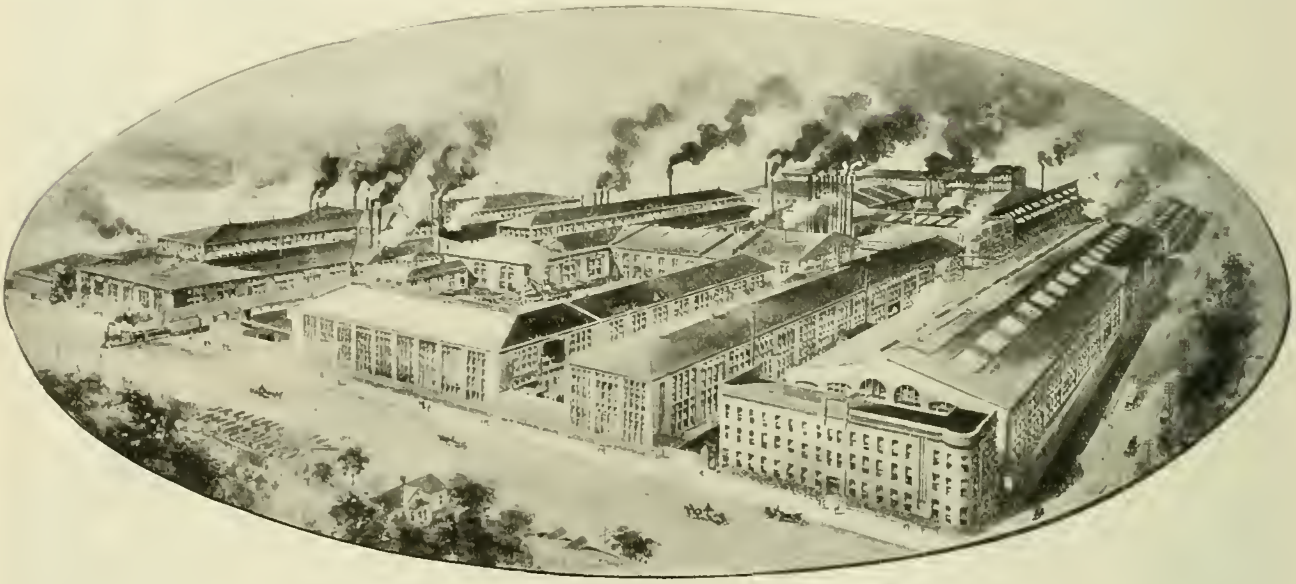
Let us see how all this trouble and expense could have been avoided.

The engine has made her first 600 miles, and is to be washed out. The boiler-washers will be inclined to say, "Ah, here's a snap—a bran new boiler; we'll just take out half the wash-out plugs and show her the hose."

Don't allow it! Have her washed out as thoroughly as though she was the dirtiest engine on the road.

To do this properly you will need plenty of water and a sufficient amount of pressure. A 1-inch nozzle will give the best service under all conditions. The pressure at the pump should be at least 80 pounds, and if the mains are small and long, or there is more than one gang of boiler-washers, 100 to 120 is necessary.

The boiler should have two wash-out holes in the top of shell, 10 or 12 inches from front tube sheet, and the same distance on either side of the center; two holes in the top of connection, 12 or 14 inches on either side of center; two or three holes on either side of wagon top, according to length of firebox (no two holes should come opposite one another); three or four holes in back head, according to its width, on line with opening under crown bars. If crown is radial-stayed, these holes should be 3 or 4 inches higher. Two holes should be in the bottom of back head, one on either side; the lower side of hole should be 1 inch above mud ring; two holes in throat sheet, in the same relative position as those in bottom of back head; one in center of throat sheet, between first and second rows of stay-bolts from top. This hole can be dispensed with if engine has circulating tubes, provided there is a hole opposite tubes which can be used for washing out. Two or three holes should be provided in either side (according to length of



BIRD'S-EYE VIEW OF PITTSBURGH LOCOMOTIVE WORKS.

* Foreman boiler maker B., C. R. & N. shops, Cedar Rapids, Ia.

box), just below swell, and three holes in bottom of shell.

If the boiler has a long firebox, a hole for inspection of side water legs should be put in either side of throat sheet, from 20 to 24 inches from mud ring, and on line with side water space; 1½ inches in diameter is large enough.

All other holes in boiler, except those in bottom of back-head and throat sheet, should be 1¾ inches in diameter, unless brass sleeves and cap are put in shell. Should brass plugs be put in bottom of back-head and throat sheet instead of hand hole plates, they should be 2¼ inches in diameter, to facilitate getting out large pieces of scale. These holes should be put in the straight part of sheet and not in the bend, where it is impossible to keep them tight.

All holes should be put in where they will not be covered up (as they often are) by hand-railing, air pump, driver-brake-cylinder, injector, gage-cock dripper, reach rod, pipes, etc., making it utterly impossible to do good washing-out.

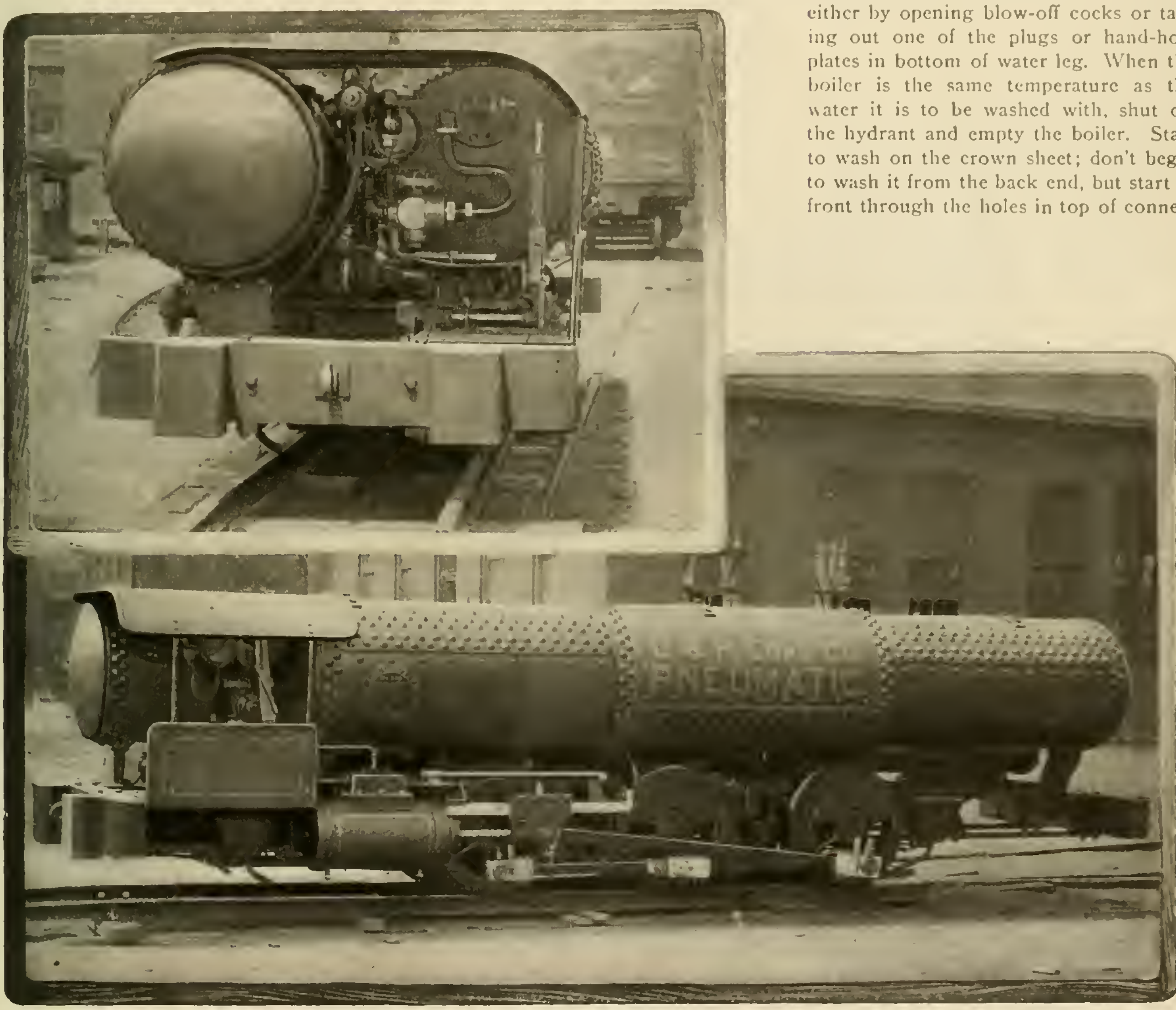
On a number of roads, four tubes are left out of boiler; the holes in back tube sheet are plugged or left out when a new sheet is put in. The holes in front tube sheet are tapped out and brass wash-out plugs put in. These holes are used for washing tubes and should be located on either side of nozzle and inside of a circle the diameter of door, making it unnecessary to take down front when tubes are washed. Deflector should be hung on hinges, and made to raise and lower conveniently.

To wash the tubes properly through these holes, make a nozzle of 1¼-inch pipe long enough to reach back tube sheet. Weld a plug in one end and cut a slot in one side (as near the welded end as possible) 1¾ x ½ inch.

If a long nozzle is inconvenient to use, or there is not room enough in front of engines, make the nozzle in two pieces.

A nozzle of this description, made of 1-inch pipe, is also a good thing to use on the crown sheet of a crown-bar boiler. To wash out bottom of shell, the nozzle illustrated and described in the June issue will be found very effective and convenient. A straight nozzle of 1-inch pipe, 12 to 16 inches long, and several bent nozzles of various shapes, will usually complete the boiler-washer's outfit, as far as nozzles are concerned.

And now we are ready to give the new boiler its first washing. We will blow off the steam and cool the boiler by taking out one of the top plugs in front end of shell, insert the nozzle, and turn on the cold water; this is quicker than cooling through the injector. Fill the boiler until the glass is nearly full, and keep the water at that level until the boiler is cold, either by opening blow-off cocks or taking out one of the plugs or hand-hole plates in bottom of water leg. When the boiler is the same temperature as the water it is to be washed with, shut off the hydrant and empty the boiler. Start to wash on the crown sheet; don't begin to wash it from the back end, but start in front through the holes in top of connection in order to keep the deposit off the tubes; wash the back end of tubes down at the same time. Next wash the crown sheet from the sides and as much of the side water space as possible. Then wash the crown from the back end and as much of the rear water space as possible, also the door ring. Now wash the tubes down from holes in top of shell at front end. If boiler has wash-out holes in front tube sheet, wash the tubes from front end next; begin at back end (top holes), and work forward, continually turning nozzle with either a pipe tongs or lever clamped on



PNEUMATIC LOCOMOTIVE—BUILT BY DICKSON LOCOMOTIVE WORKS FOR DELAWARE & HUDSON.

nozzle. When the tubes are washed clean, wash bottom of shell with nozzle illustrated in June issue; begin at front end and work back. Then wash side legs through holes below swell; next, the front leg through hole in center of throat or through circulating-tube plug, and finish by washing bottom of leg through lower holes in back head and throat. If boiler has circulating tubes, wash them out when washing crown from the back end.

Do not hold the nozzle in one position while washing, but change it constantly in order to wash all parts of the boiler accessible from the hole through which you are washing.

You will need no cleaning rods at the first washing, but they will be needed soon thereafter. Make these out of ½-inch and ⅜-inch steel of suitable lengths, chisel-pointed and hardened, with an eye turned on one end.

In order to make sure that the washing-out has been thorough, inspect the boiler. "What!" someone says, "inspect a new boiler?" Certainly. Start in the right place—at the beginning. You will not find any scale, only a very thin coating; but at each subsequent inspection you will notice just how fast it will accumulate, and also any unusual collection of scale, which is not only liable, but sure to occur, and you may possibly find a lot of bolts or other material left in by the builders. The writer has taken twenty-three different articles out of one boiler; among them was a pair of rivet tongs and a pint cup.

If you haven't any torches suitable for inspection, make several of different lengths of ⅛-inch steel wire. Turn an eye on one end and crimp the other, or turn a small eye, and tie on this end, with copper wire, a piece of waste, lamp-wick or asbestos. Dip in oil—and you have some very good torches. Make the inspection as thorough as possible. A hole in either side of back head, 10 or 12 inches from top of crown, will be found very convenient for inspecting upper part of side water spaces.

In order to make boiler-washing as effective and systematic as possible, keep a record of each washing. A very good system of keeping records and making reports is in operation on the Burlington, Cedar-Rapids & Northern Railway system. A record is kept in the boiler shop of all engines washed, noting the date, mileage, condition, name of inspector and station. A separate record is kept of engines washed at each station, noting date, engine number and mileage. At the end of each week a report is made to the assistant master mechanic, of the number of engines washed at each station, and the average mileage. Report blanks are shown below. Table 1 is the blank used by boiler-shop in making report to the assistant master mechanic. Table 2 is used by roundhouse foremen in making report to foreman of boiler-shop.

TABLE 1.

Cedar Rapids, Ia.............1897.

Mr. J. H. Burns, Asst. M. M.:

Dear Sir—Below please find report of boilers washed during week ending:

Station.	No. Engs	Mileage.
Cedar Rapids......	....	....
Estherville.........	....	....
Iowa Falls.........	....	....
Muscatine..........	....	....
Ellsworth..........	....	....
Rockford..........	....	....
Albert Lea.........	....	....
Burlington.........	....	.. . .

Respectfully submitted,

.... Foreman

TABLE 2.

Station ....1897.

Report of boilers washed during week ending ....

Date.	Eng. No.	Mileage		Remarks.
....	....	....	....	....
......	......	......	.....	....
.....	......	......	......	....
......	....	....	.	....
.....	....	.. .	.....	....
....		.	.....	....
....	......	.....	....	....
......	......	....	.....	... .

The foreman of roundhouse also has a record of each engine washed, showing date of washing and mileage. The boiler-washers have a record for their own convenience of all engines washed, showing the date of washing.

Held by His Wooden Leg.

Every other day when the St. Louis limited pulls into the Union station or the Chicago express No. 3 starts out over the Panhandle, the honest face of Jacob Rumbaugh may be seen in the cab window of engine No. 11, waiting for the little arm of the dwarf semaphore that means "go" whenever it drops from a horizontal to a slanting position.

Engineer Rumbaugh is better known as "Peggy," from the fact that he has an artificial limb. Years ago, while firing, he went under the engine to do some work, and a careless engineer started the locomotive and one of the ponderous wheels passed over his leg below the knee, crushing it so badly that amputation was necessary. In the old days, when this incident transpired, accidents were the rule instead of the exception on the Panhandle, as they are at present, and if a train got over the road without being derailed or smashed up in a collision the trainmasters and dispatchers became elated, and in the exuberance of their swelled heads forgot to perform their duty, and the next train was sure to meet with some calamity. After Mr. Rumbaugh had recovered sufficiently to be able to get about on a wooden leg, he went back to firing again, and was soon given an engine. He has been running ever since on the road, and has made an excellent record. The fact that he was appointed to run the engine hauling the fast St. Louis limited No. 2 when that train was put on the road to compete with the Big Four Knickerbocker special, shows the high confidence he maintains with the officials, and as that train has never met with a serious accident since it was started to running between this city and Dennison, no other argument is needed to show that the confidence in Mr. Rumbaugh was not misplaced.

Before he began running a passenger train he had some startling adventures, the most remarkable of which was a wreck at the Bloomfield tunnel, where his engine and train were derailed, and the wreckage piled high against the end of the underground passage. So complete was the wreck that the fireman had to go through the tunnel and come back over the hill to find what had happened, and then he was horrified to find Rumbaugh pinned down under the débris and held fast by the leg. The surviving members of the crew gathered around and began to express sympathy while rendering assistance, but the old man said: "Never mind, boys, it's only the wooden leg, anyhow, and there is plenty of material left to make another one." The fact was that Peggy's wooden leg was caught, and they soon sawed the leg off and liberated him, and he was found to be unscathed.—"Pittsburg Post."

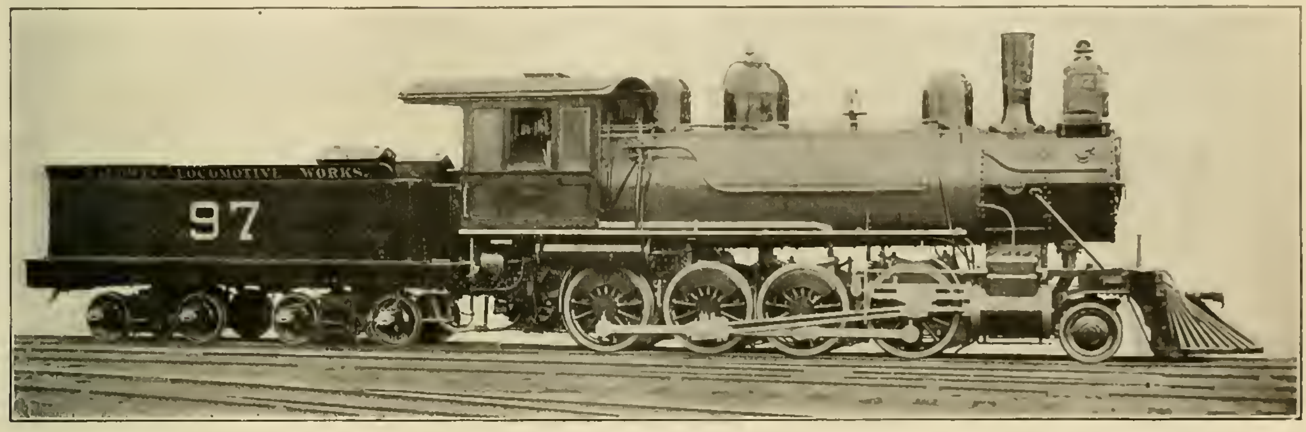
Different substances require different amounts of heat to raise their temperature through the same range. As water requires the most heat of any common substance to raise its temperature one degree, it is taken as the base and all other substances measured by it. One pound of wrought iron will be raised one degree with about one-ninth the heat required for the same weight of water, the exact figure being .1138. Cast iron is .1298, steel .1165, brass .0939, copper .0920, and lead .0314. These mean that if it requires 10,000 heat units to raise a certain weight of water a definite number of degrees, it will require but 1,138 of these heat units to raise the same weight of wrought iron the same number of degrees. Then, with these same conditions, it will require 1,208 heat units for cast iron, 1,165 for steel, 939 for brass, 920 for copper, and 314 for lead.

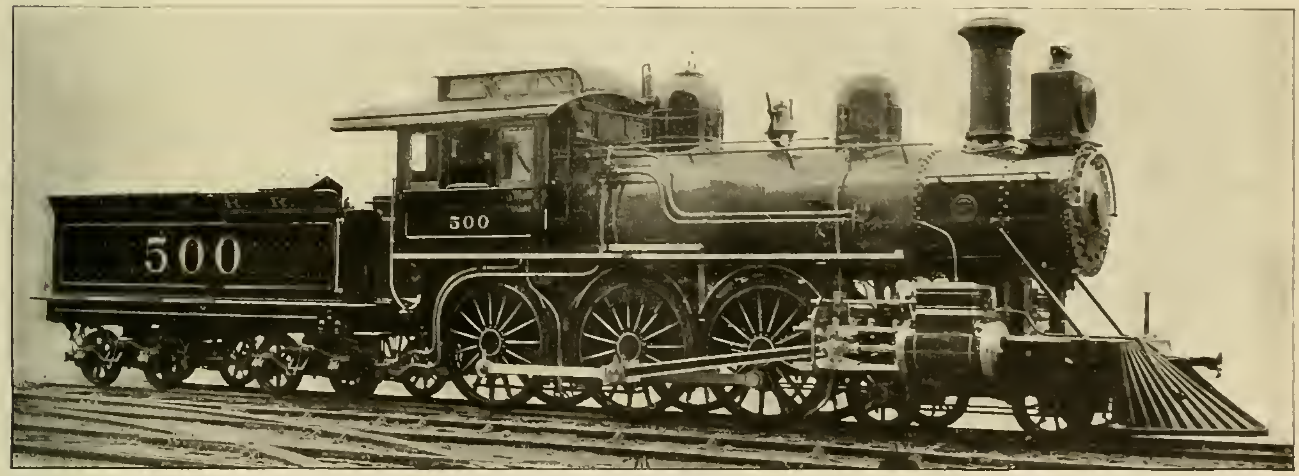
Baldwin Locomotives at Nashville Exposition.

The annexed engravings show the two locomotives built by the Baldwin people, and now on exhibition at the Tennessee Centennial and International Exposition, at Nashville, Tenn.

The consolidation engine was built for the Nashville, Chattanooga & St. Louis, after specification prepared by Mr. James Cullen, superintendent of motive power. The cylinders are 20 x 24 inches, driving wheels 50 inches diameter, and the driving-wheel journals are 7 x 8½ inches. The boiler is 60 inches diameter, built to carry a working pressure of 170 pounds to the square inch. There are 196 2¼-inch flues, 13 feet 1 inch long. Total heating surface is 1,649.17 square feet, and the grate area is 30.74 square feet. The weight of the engine in working order is 126,255 pounds. The engine is equipped with the following special appliances: Westinghouse air brake on all driving and tender wheels; Coale muffled safety valves; Leach's pneumatic sand blast; Keasbey & Mattison magnesia sectional boiler lagging; Nathan automatic sight feed lubricator; United States metallic packing and Mack National injectors.

The handsome ten-wheel passenger engine shown was built to specifications made by Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville. The cylinders are 18½ x 26 inches, and the driving wheels are 68 inches diameter. The driving axle journals are 8 x 10½ inches; boiler is 56 inches diameter, built to carry a working pressure of 170 pounds to the square inch. There are 206 2-inch flues, 13 feet 2 inches long. The total heating surface of the boiler is 1,549 square feet, the grate area being 22.5 square feet. The engine weighs 133,300 pounds in working order. The engine is equipped with the following special appliances: Westinghouse air brake; Westinghouse air signal; Standard Steel Works driving-wheel tires; Standard Steel Works wrought-iron spoke-center wheels; Monitor injectors; Coale muffled safety valves; Keasbey & Mattison magnesia sectional boiler lagging; Leach's pneumatic sand blast; Nathan automatic sight feed lubricator and United States metallic packing.





BALDWIN LOCOMOTIVES AT NASHVILLE EXPOSITION.

German scientists seem to be interesting themselves a great deal at present about the origin of petroleum. There is very decided diversity of the views expressed on this question, and some of them seem to us to be exceedingly funny. Mendeléef endeavors to answer this question by assuming a mineral origin for petroleum, through the chemical interaction of steam upon metallic carbides assumed to exist at great depths. Engler has recently demonstrated experimentally the artificial production of hydrocarbons of the paraffin series in the destructive distillation of animal fats under pressure. This interesting fact greatly strengthened the view of many chemists, that natural stores of petroleum had their origin in the decomposition of animal remains under peculiar heat and pressure conditions. Sadtler now supplements the work of Engler by demonstrating that petroleum hydrocarbons are produced in the destructive distillation, under pressure, of linseed oil, a product of vegetable origin. The results obtained by Sadtler, therefore, would permit the conclusion that native petroleum was derived from the decomposition of vegetable remains and reopens the whole question.

We notice that Kent's "Mechanical Engineer's Pocket-book" has reached the third edition, and has been revised in a few parts. The part relating to locomotive and railroad matters has been enlarged and now contains a great deal of reliable data about trains which can be found in no other book.

Queen Victoria's New Train.

In connection with the jubilee of the sixtieth year of Queen Victoria's reign, celebrated last month, there was a special train built by the Great Western Railway for Her Majesty's use. Its first service was conveying the Queen and her attendants from Windsor to London for the jubilee ceremonies.

Concerning this train, the London "Standard" says: "The principal object is, of course, the Queen's own carriage; and this is the more interesting that it is her Majesty's original one of 1874, and built at that early date upon the bogie system, and on narrow-gage dimensions. Bogie carriages were, as early as 1851, in use upon the Great Western line, as also upon the Metropolitan, between Bishop's Road and Farringdon street, when that company worked the rolling stock over it. The conversion from broad to narrow gage was carried on with much activity in 1869, and many sections were then transformed. At first these carriages were only 38 feet long, but year by year they have been increased in size until in the prize train at the Chicago Exhibition, in 1893, they attained a length of 70 feet and a cost of $22,000 per coach. The Queen having given preference to the carriage in which for so many years she has made most satisfactory journeys, and which has been lent to the London & Southwestern and other railways for her service, the company has reconstructed, enlarged and redecorated it; and this has been done with so much skill that it has absolutely the appearance and character of a new vehicle altogether, so exquisitely have the old portions and the newer been made to agree.

"The original carriage was 43 feet in length; the new one has been increased to 44, the Queen's saloon occupying the whole central portion. The entire carriage has been rebuilt upon a new very strong steel basis cased in mahogany, with finely carved lion heads over the angles of the under framing. The exterior of the carriage is painted in rich chocolate brown, highly polished, with white panels on the upper portion and handsome mahogany beading round the plate-glass windows. The exterior is also decorated with the royal arms and other heraldic finely executed paintings, the general appearance being enhanced by lines of gold. The interior of the Queen's saloon is charmingly paneled with satinwood, while the ceiling has a white ground beautifully finished by hand-painted decorations. The upholstery is of cream-colored silk taberette, the chairs and couches being finished off by green and white silk cord and lace. The window blinds and curtains, of a very pleasant green, are upheld by silver-plated rods, supported by small gilt figures of Hercules. The floor is carpeted by green and white Axminster. The saloon is also softly lighted by numerous electric incandescents variously distributed, each being turned on as wanted. The large central ground glass globe is supplied with three or six as may be desired. All the door handles and plates, the light and other metal fittings are of plated silver. The entrance vestibule has double doors, and is nearly 6 feet wide, and has a steel folding step for the Queen's convenience. It is very delicately paneled with satinwood and sycamore. At each end of the coach is an ample compartment for the Queen's attendants.

"The rest of the train is entirely new, all the carriages being on the corridor system. All are erected on steel frames, and are decorated in similar manner. In front and in rear of the Queen's carriage is a royal saloon carriage, 58 feet in length. In front there is, in addition, a first-class carriage, divided into compartments in much the ordinary way, to afford privacy to the respective occupants. The train is completed by a brake van at each end. The two royal saloon coaches are fitted up in luxurious style, the panels being of sycamore inclosed in walnut framing, and the metal fittings are of plated silver. The upholstery is of cream-colored silk taberette. The toilet rooms and other internal subdivisions are made in very convenient manner throughout the train, including the brake vans, the size of which (56 feet long) enables provision, beyond the large space required for luggage, of an ample compartment for the railway officials in charge of the train, as well as for the culinary department, with gas stove and other requisites. The whole of the excellent and beautiful work involved in the new royal train has been executed in the locomotive and carriage departments of the Swindon Works, under the direction of the superintendent, Mr. W. Dean, and his assistant officers, Mr. Thomas and Mr. Hogarth. We may add that the fine locomotive-engine Empress of India has been repainted and decorated for drawing the train, and the whole turn-out will be of the very handsomest and most efficient character."

Interesting Tests of Steel.

Prof. P. C. Carpenter, of Cornell University, recently obtained some excellent results in a torsional test of a piece of steel shafting 1.68 inches in diameter, sent him by the Finished Steel Company, of Youngstown, O. Two specimens, both cut from the same bar, were tested by torsion. The piece finished by this company's process showed a shearing strength at the elastic limit of 41,100 inch-pounds, while the untreated specimen was only 25,900 inch-pounds. In other properties the two specimens were very much the same, indicating that the finishing process does not increase its brittleness, within the limit of working stresses.

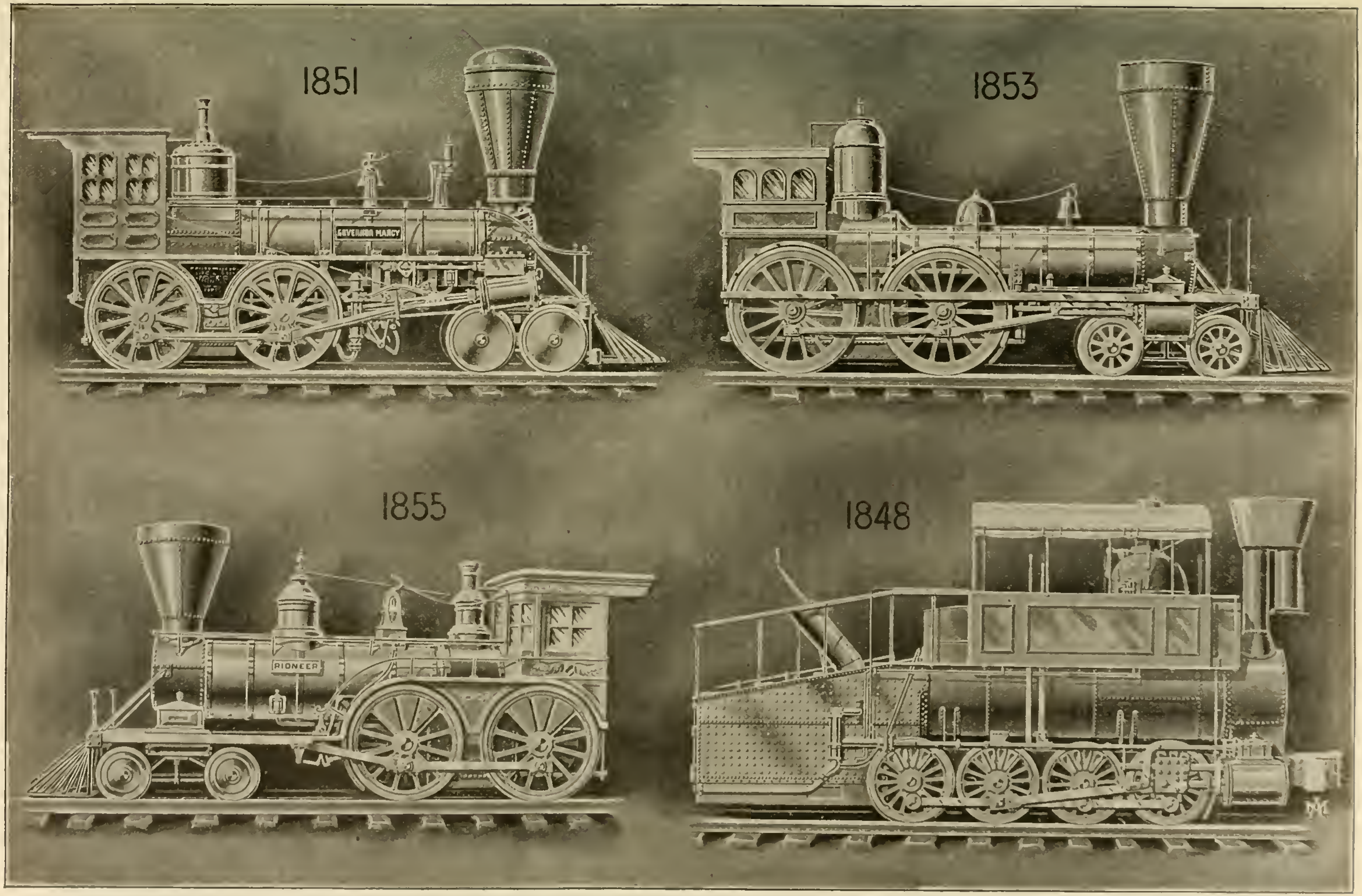
One of the fairest articles on the question of substituting electricity for steam locomotives, from an electrical engineer, is the article by Chas. H. Davis in the "Engineering Magazine." He shows the comparative cost of each system for regular railway conditions, and puts the cost balance in favor of the steam locomotive, then makes the rather peculiar statement that "the great increase in gross receipts and in net revenue may, and very often will, decide the question beyond any doubt in favor of electricity." Why the gross receipts should be greater under exactly the same conditions of traffic, population, etc. (after the "new" had worn off and the road settled down to steady business), is hard to determine, or how the net revenue would be increased when the cost of operation and maintenance is increased rather than decreased, is also a little beyond our method of reasoning. The great majority of our railroad traffic is entirely uninfluenced by the method used, but depends on the demands of one section of the country for the product of another section.

Too many shopmen are apt to forget the elasticity of a driving wheel center and the influence which the tire exerts in holding the axle in place. Although it seems almost incredible, it is nevertheless a fact that many a hydraulic press has been badly strained, if not burst, by the failure to remove the tire before pressing out the axle. Of course, the amount allowed for shrinkage of tire affects this considerably; but any tire that has shrink allowance enough to hold it on, will make itself felt when it comes to shoving out old axles.

Inventor of the Multitubular Boiler.

In an address made at the twenty-fifth anniversary of the Stevens Institute of Technology, the Hon. Abram S. Hewitt made the statement that John Stevens, of Hoboken, was the first engineer to build a Watt condensing engine on the American continent. The engine was built at Belleville, N. J., a small village on the Passaic River. It was put into a boat, to which a stern wheel was applied, and the boat was run from Belleville down the Passaic by Newark, out into Newark Bay, and thence to New York. This was several years before Fulton began his experiments in applying steam to the propulsion of vessels.

It is not generally known that this same John Stevens patented the multitubular boiler in 1803. That form of boiler was what was wanting in the earliest form of British locomotives, and its introduction by the Stephensons was the most important means of making the "Rocket" beat its competitors. In Europe the invention of the tubular boiler is generally credited to a French engineer and sometimes to an official of the Liverpool & Manchester Railroad, named Booth, who suggested to George Stephenson that he use that form of boiler.



1851. First McQueen engine.
1855. First Manchester engine.

GRAPHIC HISTORY OF THE LOCOMOTIVE.
Twelve Charts. Chart No. 7.

1853. First Mason engine. First engine with spread truck and horizontal cylinders.
1848. First Ross Winans camel engine.

NIGHT VIEWS OF NASHVILLE EXPOSITION.

Night Views of the Nashville Exposition.

Through the courtesy of Mr. Henry Monk, assistant chief of machinery of the exposition, we are able to give our readers two of the finest night views we have ever seen, those of the Chicago Exposition not excepted.

The upper view shows, beginning at the left, the Agricultural building which is built in the Renaissance style of architecture and measures 200 by 300 feet, with the central dome rising 100 feet from the ground.

Machinery Hall comes next with its solid, yet attractive architecture, measuring 138 by 375 feet. To prevent excessive heat during the summer and add to its attractiveness, no steam is admitted here, the boilers and large engines being in a separate building some distance away.

On the right is the Negro building, a substantial and attractive building in which is the exhibit of the progress of this race from the old plantation days to the present. This is on the eastern bank of Lake Watauga, as this body of water is called.

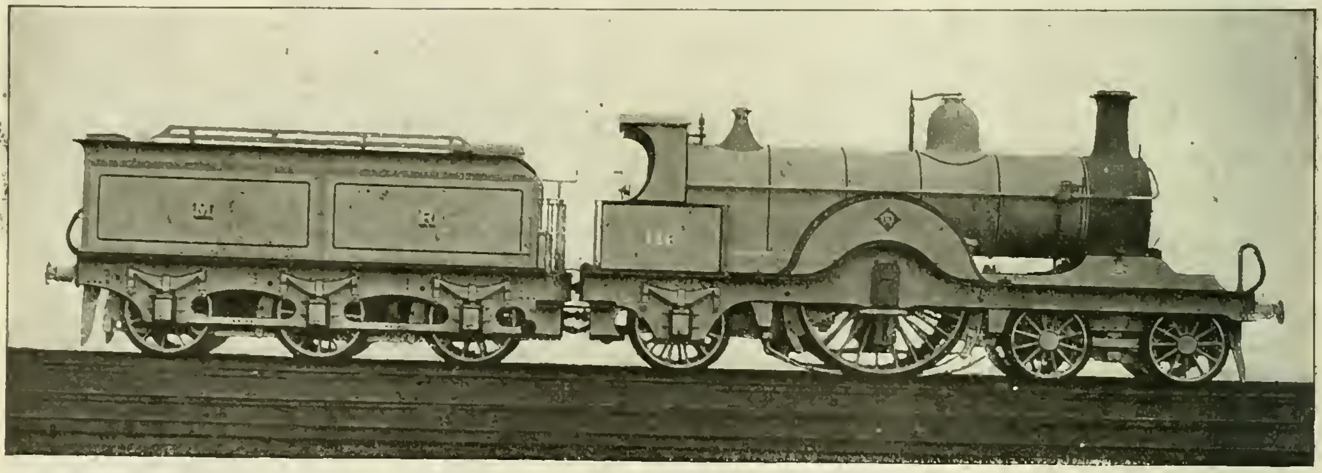
The lower view gives a better idea of the Negro building (taken from the other end of the lake) and shows the Rialto in the distance. This is said to be a faithful reproduction of the Rialto of Venice which spans the Grand Canal. Whether one is familiar with the original or not, this forms a unique attraction and shows the enterprise of the managers of the exposition.

Any person interested in steam engineering will find valuable reading in the pamphlet recently published by Professor Goss, of Purdue University, on "Indicator Diagrams from the Experimental Locomotive." Diagrams were taken under a great variety of conditions of operating, and they present a very good lesson on the indicator, in the way they appear in the pamphlet and the clear manner in which the notes concerning them are written.

Midland Locomotive.

Several of the English locomotive designers still cling to the use of express locomotives with a single pair of driving wheels. Among the most recently built engines of this class, we show a fine specimen designed by Mr. S. W. Johnson, locomotive superintendent of the Midland Railway and built in the company's works at Derby.

The cylinders are 19½ x 26 inches and the driving wheels 93 inches diameter. The novelty about this engine for English practice is that piston valves are employed in the distribution of the steam. The boiler provides 1,235 square feet of heating surface and 21¼ square feet of grate area. The working pressure is 170 pounds per square inch.



MIDLAND RAILWAY EXPRESS ENGINE.

How the Superintendent Stopped Racing.

It wouldn't do to tell what road it happened on, but it happened nevertheless and shows that trait of human character where almost any man likes to get ahead of the other fellow. Two roads ran parallel for several miles, and the engineers of the two roads often had a friendly brush when they happened to meet at this point, and they managed to meet pretty often too—who doesn't like a race?

Complaints were entered and strict orders were issued that the racing must stop, but still reports of fast running at this particular point continued to be made. The division superintendent said he'd fix 'em, he'd ride on the engines and see if it couldn't be stopped.

So he got on the 129, which hauled the express and never said a word about racing, but kept his eyes and ears open to see or hear something suspicious between the engineer and fireman. They neared the racing ground and sure enough there was the other express about even with them on the other track, but still no sign of guilt on the part of the engineer or fireman. The former kept his eyes on the track ahead, apparently oblivious of the other train and the fireman watched the steam gage, as all good firemen do, so as to put in just coal enough to keep steam up to the top notch, but not a look or glance or signal of any kind passed between them and to all appearances neither of them saw or heard the other train.

The superintendent was getting interested now and he saw the other train was holding its own at least—and the engineer never seemed to see it or to care whether it beat them or not. This engineer never raced, that's sure. The super could stand it no longer and he went close to the engineer, "Can't you open her out a little Bill, I hate to see that —— road there run faster'n we do." "Can't do it Mr. S., you know I'd get fired for racing and Bill Johnson isn't taking any risks of either being fired or blowed up." Truth to tell, he was crowding the 129 all it would stand, but he didn't give that away to the super.

"Hang the rules Bill, beat her if you can, there's that new superintendent of the —— line grinning at us from the baggage car, beat her or bust, I'll see you don't get fired."

"Couldn't think of racing Mr. S., not without a written order from the G. M., but" as he lowered his voice a little "if the 129 can hold her wind till we break over this grade, I rather guess she'll drop down into Noburg first, its a kind of a trick of her's Mr. S., but she never races —nary a race."

The experimental locomotive, Schenectady No. 1, has been moved from Purdue University preliminary to putting in the experimental laboratory a much larger engine, capable of being changed in many ways for experimental purposes.

"The World's Rail Way," the most handsome mechanical book ever published, is going rapidly. Those who wish to have the book should send for it without delay.

Locomotive for Japan.

The annexed engraving illustrates one of a group of locomotives recently built by the Brooks Locomotive Company, for the Koya Railway, of Japan.

The engine is of peculiar design, being a double-ender with pony truck at each end. The cylinders are 15 x 22 inches; driving wheels, 50 inches diameter; boiler is 51 inches diameter and carries a working pressure of 150 pounds. Total weight of the engine is 92,000 pounds, of which 70,000 pounds are on the drivers.

LOCOMOTIVE FOR JAPAN.

Self-Propelling Fire Engine.

It is rather surprising how long some good things remain unknown, while the freaks and other useless devices are too much in evidence for the peace of mind or the pocket-books of the investing public. With all the talk which has been recently indulged in about horseless carriages of various kinds, it seems a little strange to find a self-propelling fire engine which has been doing constant service since 1889 and has given the best of satisfaction. But Hartford, Conn., has been using the one shown herewith for 8 years and began using this type in 1876.

The present engine, the No. 3, was built by the Manchester Locomotive Works, and cost $7,000. The engine weighs 8½ tons and has steam cylinders 9½ inches in diameter, pump cylinders 5½ inches in diameter, the stroke of all cylinders being 8 inches. The maximum capacity of the pumps is 1,350 gallons per minute, although the engineer, Mr. John R. Davis does not think this is often, if ever reached in actual work. Mr. Davis is very enthusiastic over his engine and takes a great pride in explaining its good points; which by the way, is probably one reason for the engine's great success. The city of Boston has recently purchased a similar engine, but they apparently lack the man to make it a success.

The No. 3 (or "Jumbo" as it is called) stands ready for action at all times and usually crosses the door sill in 8 seconds after the alarm is received. It climbs any hill in Hartford with ease, and horses are not to be compared with it for speed, it being at least 50 per cent. faster.

Railroad Organization.

To the average motive power man the purpose of the various other departments is vague and unintelligible. In an article written by President Baldwin, of the Long Island Railroad, to the "Harvard Monthly," the following paragraphs appear:

The organization of a railroad comprises six principal departments, and for the purposes of this paper the following classification is proper:

"1. The Executive—including financial.

2. Traffic—Passenger and freight business.

3. Operation or transportation—Motive power and cars; purchasing; store; medical; department of tests.

4. Engineering—Maintenance of roadway; bridges and buildings; new construction.

5. Legal.

6. Auditing.

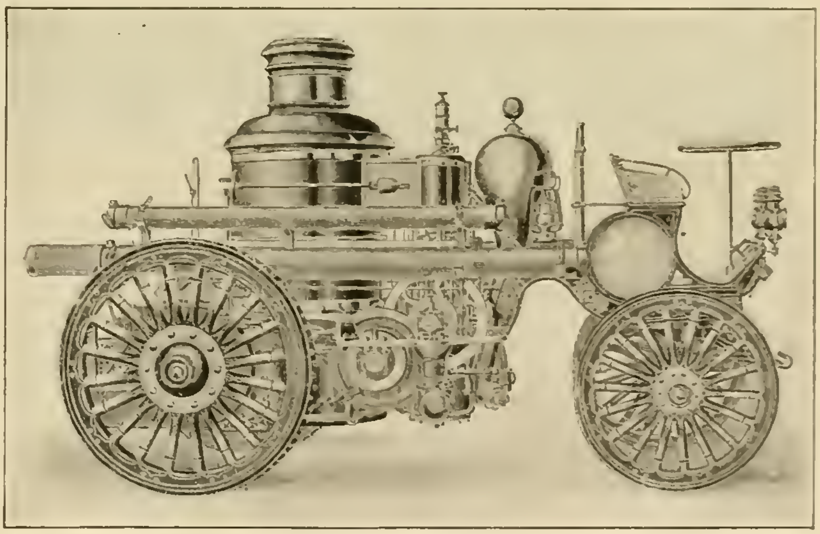
The executive officers define the general policy of the road and direct its finances.

The traffic officers make the rates for both passenger and freight business and are responsible for the revenue. Rate making is the most intricate subject connected with railroad work. It necessitates a careful study of economic and business questions. The competition of various markets, of different localities, of other competing lines, etc., make the most difficult problems in the business world. For this reason a knowledge of economics and mathematics, and good business judgment, are necessities to the successful traffic man. The traffic department provides the business for the transportation department.

The transportation department provides the trains for the movement of the traffic, and deals with the problem of transporting passengers and freight to their destination with speed, safety and the greatest possible economy. Economy in railroad transportation is of first importance, not only to the railroads, but also to the public, as the ability to reach distant markets depends upon the economy of operation.

The officer in charge of transportation has the care and discipline of men in train service. The direction of thousands of men in train service where the highest degree of efficiency and accuracy is necessary demands executive qualities of a high order—not only the qualities of an army officer, but wisdom and discretion in dealing with the important wage and labor questions.

The present efficiency in railroad service and the possibility of operating thousands of miles of railroad under one management are largely due to the mutual confidence between railroad companies and their employés, which has been developed within recent years.


MOTOR FIRE ENGINE.

The subordinate branches of the operating department are many.

The care of the motive power and cars is under the direction of a mechanical engineer. The efficiency of the motive power is a very important element in the economy of operation. One of the most distinguished railroad men of his time had been the superintendent of motive power of a great system of railroads, and had prepared for it by an academic degree at Harvard and a thorough course in the shops.

The purchasing agent may buy supplies amounting to many millions of dollars per year, and he must purchase them of the right quality and at the lowest price.

The storekeeper has in his charge the large stock of all kinds of material necessary for the repairs and maintenance, and on proper requisition supplies the department in need of material.

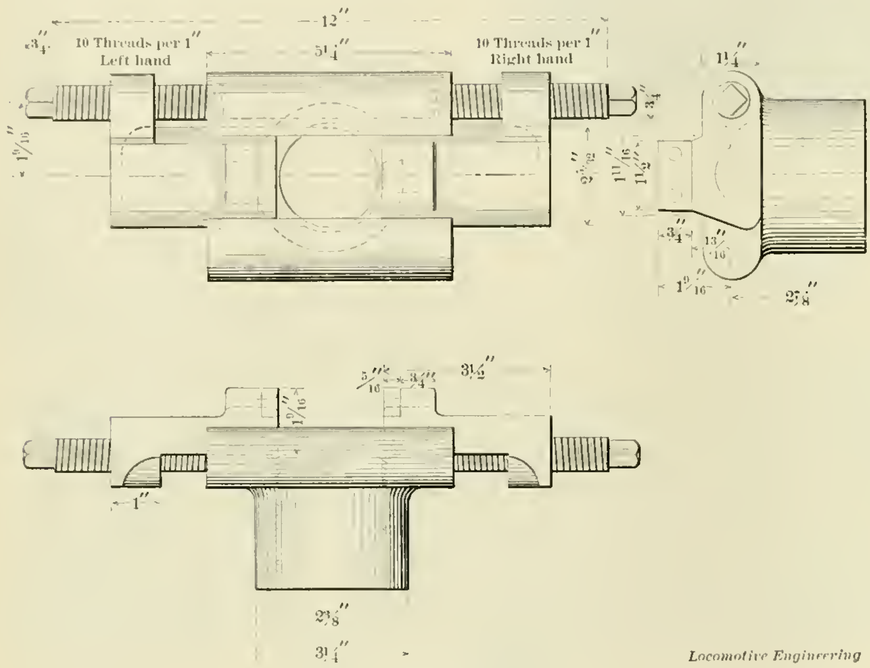
The chemist and engineer of tests examines, tests chemically or mechanically all material purchased, to see that it conforms to specifications.

The medical department is for the care of all employés injured in the service, and many roads provide ample hospital facilities.

The engineering department is managed by a civil engineer. He keeps all standards of construction, lays out new lines and new work on the road. He may superintend the maintenance of the roadway and track, and the repairs of all the bridges, buildings, etc.

The legal department is very important. The enormous amount of litigation growing out of the quasi-public interests of railroad corporations, and the necessity of giving constant attention to the political relations between the railroads and the public, demand men of the highest legal and diplomatic ability.

The auditing department keeps the accounts of the income and disbursements.



SMALL LATHE CHUCK.

First Rails Rolled in America.

In the course of an address at the twenty-fifth anniversary of the Stevens Institute of Technology, the Hon. Abram S. Hewitt said: "In the year 1846, more than fifty years ago, Mr. Edwin Stevens sent for me one day and said that the Camden & Amboy Railroad Company wanted to get 2,000 tons of rails, and that it was impossible, owing to the great scarcity of the article, to procure them in time to be laid in that year. He said, however, that he was prepared to pay the cost of importation if my firm would undertake to make the rails at the price offered, which was $90 per ton. We had just built a little wire mill at Trenton for the manufacture of wire. Now, wire is very much the reverse of a railroad bar.

"Mr. Stevens said: 'I want you to make 2,000 tons of rail, weighing 65 pounds to the yard,' which was the heaviest rail at that time made in the world. I afterwards discovered that the pattern, like all the inventions of the Stevens family, was peculiar, and somewhat difficult to roll. Nevertheless, I finally agreed to make the attempt, and as a matter of fact we succeeded in delivering 2,000 tons of rails, for which we received the sum of $180,000 in hard cash.

"Robert L. Stevens, as you all know, was the designer of what is known as the flange rail. He had it made in Wales at the works of Sir John Guest, and with such expedition that within two years from the time of undertaking the practical scheme of building the Camden & Amboy Railroad, that railroad was constructed, running and carrying passengers and freight with entire success between Philadelphia and New York. Robert L. Stevens and his brother Edwin, who was the business manager of the enterprise, thus performed in two years a feat which at that time, if you will consider the development of the mechanical arts, the state of the financial transactions of the world, and the unknown elements which entered into the problem, was a greater performance than if any man were to undertake at this time to build a road from New York to San Francisco in two years.

The world never saw a greater triumph than the construction of that road, and out of its operation have come all the developments which have culminated in the modern railway and its wonderful appliances. They had to provide cars, because there was no model for cars. They were, however, the proprietors of the Union Line, which carried passengers from New York to Philadelphia. Forty coaches, often in a line, would start from New Brunswick (on the arrival of one of the Stevens' steamboats) across the State of New Jersey, drawn by thoroughbred horses to Trenton, where the old buildings which were constructed by the Stevens family of solid brick and mortar, stand to this day, and where the house still remains in the possession of my family, in which John C. Stevens, who was the superintendent of the Union Line, resided and superintended the business; for the peculiarity of the Stevens family was that whatever they undertook to do they did themselves. They had subordinates, they had trusted men, they had tried assistants, but the superintendence of the work to the minutest part, was done by John and Robert and Edwin Stevens.

A Small Lathe Chuck.

A convenient accessory to a lathe doing a small class of work, more especially bolts and set screws, is the chuck which we illustrate in this connection. It is in use at the New York, Ontario & Western shops at Middletown, N. Y., where those seen in commission were built. The rig consists of a cast-iron body which is bored and threaded to fit the lathe spindle, it taking the place of the face plate when in operation, and two jaws actuated by a right and left hand screw. The jaws having a lug at one end for the screws, have beveled sides which fit into a corresponding groove in the body, the latter being tapped for the right and left hand screws. Any motion of the screws causes the jaws to advance or recede, and thus make a very simple and handy chuck for a large number of lathe jobs in a railroad shop. No claim of originality was made for this device; in fact, it may be quite ancient, although we cannot trace its age, but it has not lived long enough yet to get into all the shops that would derive a profit from an acquaintance with it.

Practical Letters from Practical Men.

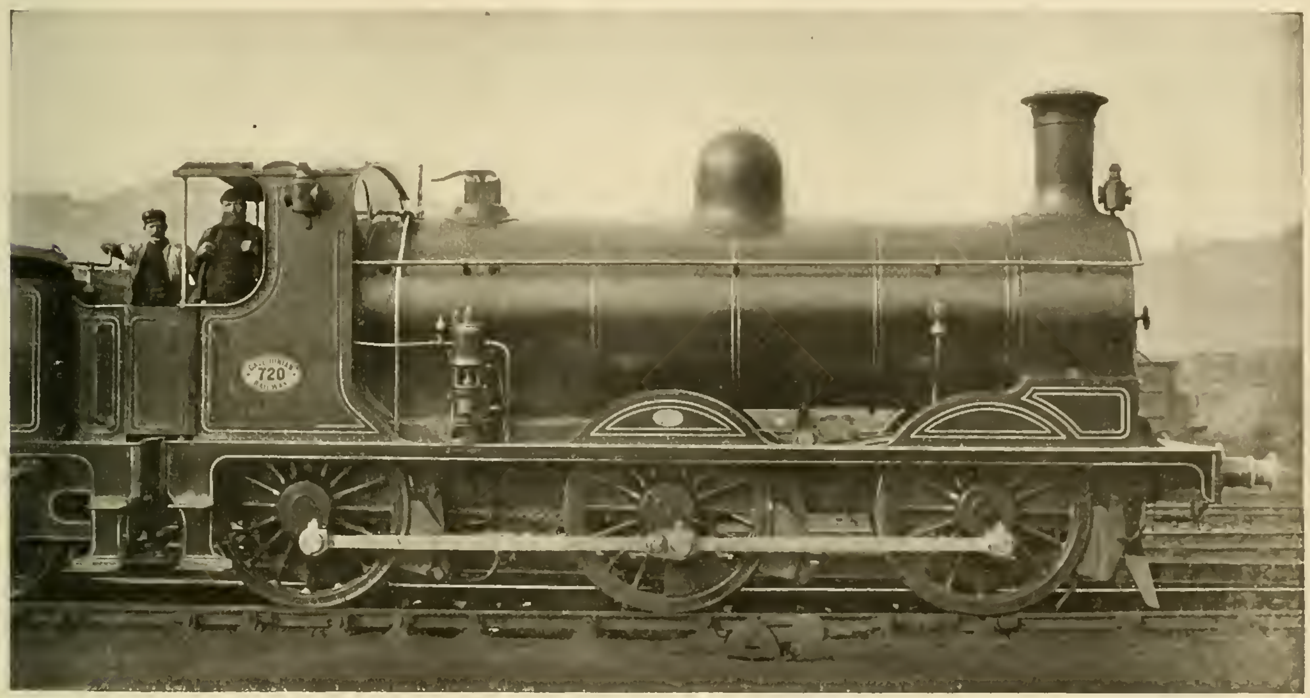
Steam Road that Used Electric Traction a Year Ago.

Editors:

In your June issue of the "Locomotive Engineering," on pages 419 and 420, under the title of "A New Experience with Electric Traction on a Steam Road," is an article on the subject of operation of electric and steam trains over the same track, and a copy of the first train order to a motorman. I beg to say to you that the article referred to does the Wellston & Jackson Belt Ry. an injustice, inasmuch as our company operate a line 11 miles in length between Wellston and Jackson, Ohio, and same has been in successful operation under the above system since March 1st, 1896, a little over 15 months. I enclose for your information copy of time table No. 6.

M. S. CONNERS,
Superintendent.

Columbus, O., June 8, 1897.



CALEDONIAN RAILWAY FREIGHT LOCOMOTIVE.

Caledonian "Goods" Locomotive.

Editors:

As I have seen in "Locomotive Engineering" some excellent pictures of our British passenger engines, but never one of our typical "six-coup goods" (undoubtedly the most numerous class of engine in the British Isles), I have to-day sent you per book post a photo of one of the standard goods, Caledonian Railway. Sixty of these, fitted with Westinghouse brakes, have been built at St. Rollox during the past year, and are used on all classes of traffic—fast passenger, excursion, goods and mineral. The tenders are the usual Caley six-wheel type.

The principal dimensions are:

Boiler press.—130 pounds.

Heating surface—Firebox, 112.4 square feet; tubes, 218 of 1¾-inch, equal to 1,056.8 square feet. Total, 1,169.2 feet.

Cylinders—18 x 26.

Diameter of wheels—5 feet (on tread).

Weight of engine and tender in working order—77 tons 13 cwt.

Trusting that you may consider above worthy of insertion, and with best wishes for your paper, which, for a Yankee, is extremely fair to the "durned furriner,"

SAM A. FORBES.

Perth, Scotland.

P. S.—For particulars I am directly indebted to the kindness of John McIntosh, Esq., St. Rollox.—S. A. F.

Bridging Exhaust Nozzles.

Editors:

Although the Master Mechanics' Association (1896) has apparently set its face against the practice of inserting crossbars into exhaust nozzles, does not such condemnation seem almost premature in the light of discoveries made by Professor Goss and others in connection with the action of the exhaust jet mentioned by you in the July number, 1896, page 624—although I know that for one of the rank and file to even attempt to question such a decision is to no doubt render himself liable to an application of the maxim that "Fools rush in where angels fear to tread." The principal objection to their use appears to be the claim of increased back pressure, which must be attributed to the friction of the steam on the sides of the bar, provided always that the diameter of the nozzle is increased sufficiently to compensate for the area blocked up by the bar, which appears to be almost practically insignificant in amount, considering the success and free running qualities of the Smith triple-expansion exhaust pipe, whose several orifices present a frictional surface several times greater than any arrangement of the common nozzle.

Again, in the article before mentioned, page 624, July, 1896, you state that "it was found that the fuel gases do not mingle with the steam until nearly half-way up the stack; they ascend most of the way clinging to the surface of the exhaust jet. The action of the jet in creating a vacuum is almost entirely inductive, of the same character as that of an injector lifting water."

Now, if this be true that the gases only cling to the surface of the jet, is it not a reasonable deduction that (the jet issuing at equal velocities, of course) the adhesion and consequent discharge of gases is almost proportional to the steam jet surface presented to the gases? Now while it is convenient and desirable in some ways to have the jet round, still it i evident that this form presents the least possible amount of surface to the gases upon which to cling, while a nozzle of sufficiently increased diameter with a bar would form a jet having practically the same circumferential surface plus twice its diameter along the sides of the bar, or, roughly, an increase of jet surface of about 40 per cent., and the gases being drawn into this split in the jet just over the nozzle, and adhering to the flat surfaces, increase the discharge of gases without a proportionate increase in back pressure; and beside, these gases being forced into intimate contact with the steam, impart to it a portion of their heat, thus increasing its expansive force, and assisting to maintain its initial velocity and increase its volume. Actually, in road practice, it has been found that a proportionately greater nozzle with two bars in, set at right angles, but in the same horizontal plane, will produce a still greater draft than an open nozzle or one with a single bar whose open areas are equal. I believe I am justified in believing that the majority of engineers and others who have carefully observed are satisfied that bridged nozzles generally produce the greatest draft, open areas being equal.

In the article referred to you appear to be optimistic of great improvements and economies, as a result of the discoveries mentioned, and I am sure everyone interested, and especially firemen, say Amen!

S. J. Hungerford,
Canadian Pacific Railway.

Montreal.

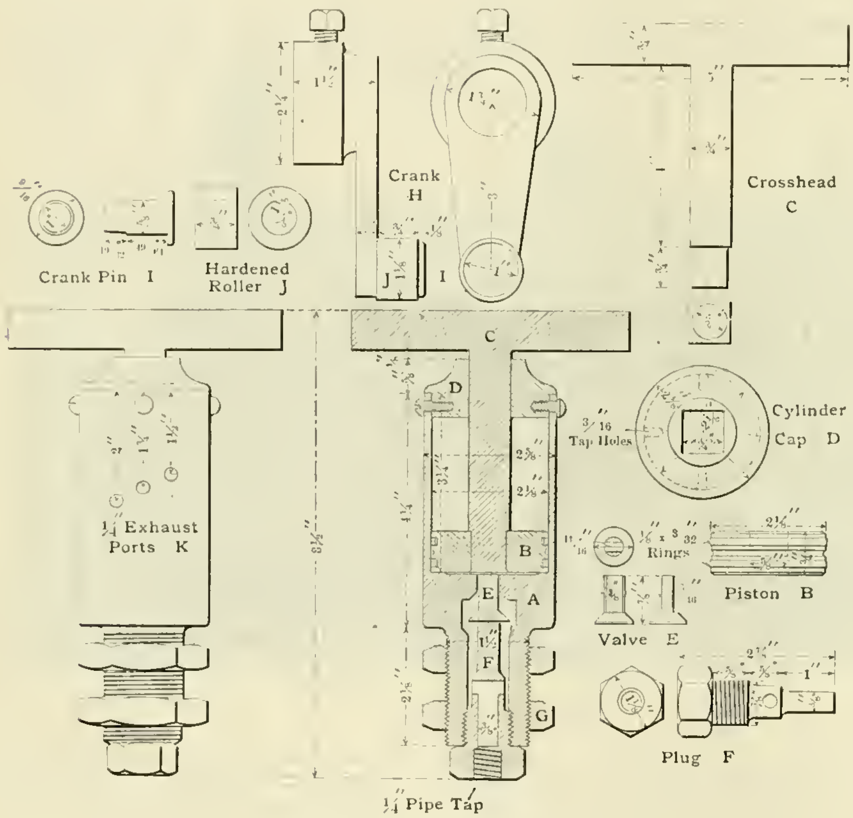
Use of Dampers.

Editors:

I read the letter of Mr. J. J. Clair, in your April number, with much interest, in regard to the regulation of the fire by judicious handling of the dampers. I was roundhouse foreman at one time, in charge of the station from which Mr. Clair was running, and I fully concur in his views on this matter. The greatest obstacle at present, however, is the difficulty in operating the damper rigging, and its availability for use when required. In some cases it is entirely out of reach of the fireman, and owing to the bent and battered condition of the levers, cannot be lowered at all. I have seen it demonstrated that the fire can be preserved, on a long drift down hill, without the pop raising, by either partially or completely closing the front damper. It is, however, hard to instill this into the fireman, whose ambition is only bounded by pay day, and the conscientious engineer who is striving for a good position on the performance sheet is often seriously handicapped from this cause.

The many valuable and practical books which have been written in late years, treating on scientific combustion from a practical standpoint, are gradually becoming the means of awakening the lazy fireman to the fact that it is to his interest, as well as that of the company by whom he is employed, to study economy. In my experience, I hardly think that on one-tenth of the engines I have observed that the dampers were ever worked at all. I fully agree with Mr. Clair's views in this matter; but, of course, there must be some radical improvements made in the damper rigging on the majority of engines before their proper handling will prove practicable.

Robert H. Rogers,
Mexican Central Shops.



McELVANEY'S BELL RINGER.

Simple Form of Bell Ringer.

Editors:

I forward you by this mail, blueprint showing device for locomotive bell ringer, to be operated by air.

The ringer is fastened to bell frame as shown; operated as follow: Air is admitted at lower end of plug *F*, and passes by valve *E*, into cylinder *A*, under piston *B*; when piston *B* has made a slight movement upward, valve *E* closes and the air in cylinder, by expansion, forces piston up till it passes exhaust ports *K*, when it drops back till it touches valve *E*, which is held to seat by air pressure underneath valve. In making upward stroke, the tee head piston rod *C* strikes the crank *H*, which is set a little to one side of center line and swings the bell; as the bell drops back, crank strikes piston, which forces valve *E* open, admitting air to cylinder for next stroke.

Crank *H* is provided with roller *J*, fastened by pin *I*, to overcome friction as it passes over tee head piston *C*.

You will note there is no connecting rod, and very few working parts, and it is about as simple and cheap as any ringer I have yet seen.

This device is not patented.

C. T. McElvaney,
M. M., Missouri, Kansas &
Texas Railway.

Denison, Tex.

The Fitzpatrick Flue Cutter.

Editors:

I inclose you sketch of the Fitzpatrick flue cutter, in use in the shops at this place. I have been using this tool for the past eighteen months. Last year we cut out seventy-two sets of flues at an average cost per set of $6, a saving to the company of from $4 to $5 per set. The cost of repairs on the cutter would not exceed $5 for the whole year. Some cutters will cut out three and four sets, while others will only cut out one set.

We gave this tool a test last week, taking out a set of 236 2¼-inch flues in 8½ hours. This includes taking thimbles out of front heads. The total cost of taking out that number of flues was $4.03. We have an air attachment nearly completed for applying to operative tool, which will greatly increase the speed of doing work.

C. O. Alexander,
Foreman Boiler Maker.

Raton, N. M.

The English and Metric Systems.

BY CHARLES T. PORTER.

I am filled with astonishment and indignation, to see the cause of our good old English system of linear measurement so meekly given away; to see the pretensions to superiority which are arrogantly put forth on behalf of the metric system, admitted, directly or tacitly, by those who are in the actual enjoyment of a system which is incomparably its superior.

I know very well what the word "incomparably" means, and I know what I mean when I use it. I mean that, when the English and French systems are fairly compared, in a comprehensive manner, taking into consideration all their applications, the English system will be found to be so greatly superior that there is no comparison between them.

Here one of those wiseacres, who are always ready to pronounce judgment before they have heard the case, is announcing his decision; maybe a good many of them are doing so, as follows: "Porter has made a blunder. He has taken an extreme position that he cannot maintain, and so has destroyed in advance whatever weight a judicious and rational argument might have had."

I am not much in the habit of taking untenable positions, and I have not done so now. I hold myself bound to prove the proposition I have above laid down, in its most literal and absolute sense, and I undertake to do it to the complete satisfaction of every man who can read the English language.

Before entering on a comparison of the two systems, it is in order to call attention to the almost incalculable loss and inconvenience that would be involved in the change from our existing system to the metric system. Now I see the look of scorn that curls the lips and elevates the noses of the advocates of the metric system, that weight should be allowed to so paltry a consideration as this, when such a blessing is to be attained.

What does anyone suppose it really would cost us to reach that beatific condition in which a woman could send her little boy to the grocery for six-tenths of a kilogram of cheese, and could order from the "magazin" of dry goods a meter and eight hundred and fifty-six millimeters of calico, and, that our blessedness might be complete, could pay for them in centimes? Could we get there by the sacrifice of not more than one-half of our posessions? Because if we could, these fanatics would have us start at once.

Really, however, I find myself in agreement with them, in holding that this consideration of cost has nothing to do with the question; for if the change could be made without the least loss or inconvenience to anybody, then to make it would be simply idiotic, being the abandonment of the most perfect system in the world for one that, for all general uses, is incomparably inferior.

I must first pay my respects to the scientific character of the metric system. The Frenchman exclaims: "Dis is ze only systeme scientifique," "Nous avons un grand systeme scientifique," and the English and the Americans, taunted with the humble origin of their own system, and the barleycorns, and the nails, and the hand, and the foot, and the length of King Henry the First's arm, and the pole, hang their heads, and stand speechless, in the presence of this grand scientific system; ready to admit that it must possess some wonderful advantages, though they don't know exactly what, probably because they are not sufficiently acquainted with it; for its advocates argue very plausibly, a system which has maintained its position for a century, which many other nations have adopted, and which is in universal use for scientific purposes, must have well grounded claims to superiority.

I propose to show that this claim, that the metric system is scientific, is the most arrant humbug that was ever palmed off on the world, and it won't be much of a job either.

The French Revolution brought into clear light the want of balance in the French character. Among many more serious exhibitions of this weakness, there appeared this one, of an infantile nature: They would determine the exact length of the meridian circle (so called, although it is not a true circle)—that is, of the line drawn on the surface of the earth, at the level of the sea, intersecting the equator at any point, and passing through the opposite poles—and they would take one forty-millionth of this length, known as the ten-millionth of the quadrant of the meridian, and establish it, by a firm decree, to be the grand universal standard unit of length, for all distances and dimensions, small and great, on the earth and in the heavens.

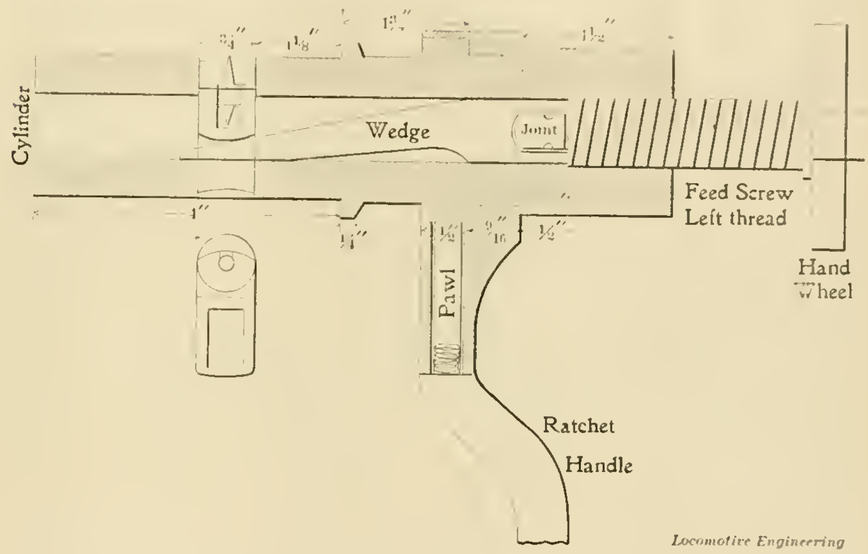
This idea was excessively French—that is, it was big and empty. There never has been more ridiculous nonsense masquerading in the garb of science, as the result proved, in the funniest and most conclusive manner. To obtain the exact length of the meridian was in itself a highly important object, one which men of science had then been engaged about for a century, and have been almost ever since—for, on account of the oblate figure of the earth, this determination was found exceedingly difficult—but to obtain it for the purpose of making it the basis for linear measurement was a mere childish fancy, that no one but an unpractical Frenchman could ever have thought of.

Well, after immense labor, the commission appointed by the French Government succeeded, as they supposed, in determining the length of the meter, and this exact length was marked on a metal rod, which was deposited in the Archives in Paris, and was decreed to be the grand universal standard aforesaid.

Subsequent measurements, however, proved that the length of the quadrant of the meridian found by this commission was too short by about 6,200 English feet, or more than a nautical mile, the now accepted length of this arc being 10,001,887 French meters; so the meter is too short by about .0074 of an inch. This humiliating discovery does not trouble metricists. They continue to mistake grandiloquence for common sense, and to boast of the grand scientific system, in apparent ignorance of the fact that its pretension has had the bottom knocked out of it.

In fact, the meter represents nothing. It is a mere arbitrary unit. It answers the purpose of a standard, however, just as well as if it really were the wonderful fraction it was supposed to be; and so any other rod, that was of a nature to maintain a constant length, cut off to any length whatever, and made by law the standard, would have served just as well.

The wonderful scientific work of the commission determined nothing, except



FITZPATRICK'S FLUE CUTTER.

its own absurdity for the purpose for which it was performed. The ancient fable had perhaps its fittest illustration; the mountain was in labor, and a ridiculous mouse was brought forth.

"But," says the metricist, "from the meter we derive the kilogram, the standard unit of weight." It will need only a few words to show that this was even a greater absurdity than deriving the meter from the meridian. There is no relation between the standard of length and the standard of weight, except that which exists in the French imagination. There is a relation between the dimensions and the weight of every substance, but this is in every case a different relation. It is a great confusion of thought to argue from this that any relation exists between the standards of weight and of length.

As no such relation exists, of course none could be shown by any scientific method. The French found it necessary, therefore, to resort to an unscientific method. It was decreed that the kilogram should be the weight of a cubic decimeter of water. Measuring water is utterly unscientific. Where exact determinations are required, scientists do not measure; they weigh. The method of measurement involves so many liabilities to error, that there can be nothing certain about the result, except that it is wrong. If the French Government had appointed twenty commissions to get this weight, they would have produced twenty kilograms. There is not one chance in a million that any two of these would have exactly balanced each other. If the block of platinum representing this weight, which is the real standard kilogram, were to be lost, scientists know perfectly well that it could not be exactly restored by the original method.

We have, then, another arbitrary unit, representing nothing; and we know that any other block of metal, of any size whatever, of a nature to retain its original weight, and made by law the standard, would have answered just as well. And so all the science we have found consists in the establishment of these two arbitrary standards.

This the metricist is obliged to admit; but he replies: "The English standards are arbitrary also, and you have not the one grand universal standard." To this we answer: "It is a matter for profound thankfulness that practically we have not, although the yard is our legal standard. We are under infinite obligation to the common sense of our ancestors, that we are not confined to a single unit. The English standards are arbitrary only in the sense in which everything fixed by law must be arbitrary. In another and the essential respect they are not arbitrary. In their selection a principle was observed, the principle of convenience; and when we reflect upon it, we perceive that this is the only rule that ought to govern, in the selection of these most important units. We perceive further, that the practical application of this principle of convenience requires that there shall be a number of units, for different uses, the only necessary connection between these being that they shall be commensurable with each other. It is obvious that the unit which is most convenient for the measurement of land and geographical distances cannot be the most convenient for the measurement of cloth, and, again, that the unit which is the most convenient for the measurement of cloth cannot be the most convenient for use in the manufacture of machinery, where a multitude of small dimensions, and dimensions differing from each other by only small amounts, need to be employed.

Acting on this common-sense principle, of convenience for varied uses, our wise ancestors have given us that marvel of convenience, the English standards of linear measurement, the mile, the rod, the yard, the foot and the inch; the latter the priceless possession of the English-speaking engineer and constructor of any form of machinery or mechanism whatever. It is to be observed that everyone is free to choose any of these units most suitable for his use, and also to combine them in any manner he sees fit. And now I would like to know what comparison is possible between this system and that which has only one standard, selected without reference to convenience; that is ordained for all uses and not adapted to any?

The selection of the meter as the universal standard of length in the French system was blunder number one. I now pass to blunder number two. This was the selection of the decimal system as the only system for the division or the multiplication of the meter.

The usefulness of the decimal system lies within narrow limits. It is invaluable, and even a necessity, for the expression of small quantities and values, and of those which could not be exactly or approximately expressed in any other way. For this reason it has always been used in mathematical tables, to express quantities less than unity. The wonderful power of the decimal system in this field completely turned the heads of the unbalanced Frenchmen, and they proceeded to the greatest of all absurdities, the adoption of this system as the universal and only mode of division.

It is utterly unadapted to large measurements. We might divide the yard decimally, just as well as the French could the meter, but what nonsense it would be. We see its unsuitableness at a glance. Instead of it, we employ the natural system of division, that which first occurs to everyone—the division by continual bisection into halves, quarters, eighths and sixteenths, and so on. The yard and the inch are divided in this manner. This division is not applied to the foot, as lengths less than one foot are expressed in inches. This method of division is not fixed by law. Everybody uses it, simply because everybody prefers to use it. Everybody could use the decimal system if they wanted to. For all uses of the yard, and for 9,999 out of 10,000 uses of the inch, the natural system of division is employed, as most conveniently meeting all requirements. We employ decimals of the inch only when we are obliged to. Then we avail ourselves of the decimal system gladly; but there must be some special reason for its use. It is to be observed, that for the expression of small dimensions by decimals, the inch is found to be a most convenient unit. An amusing illustration of the universal preference for the natural method of division, was told me, thirty years ago, by the superintendent of the Whitworth Works, in Manchester. When Mr. Whitworth began the manufacture of cylindrical gages, he lost his head, like the Frenchmen; but, by the kind assistance of his fellow-countrymen, he soon found it again. He conceived the idea that decimal divisions of the inch would be an improvement on the natural divisions, and that he had influence enough to effect the change. So he made his gages to decimals, and put them on the market, but nobody would buy them. He had to call them in and make what people wanted. "And now," said my informant, "there is not a decimal gage anywhere, even in our own shop."

An interesting feature of the natural system of division, and one by which everybody, either consciously or unconsciously, is attracted to it, is that all the divisions are aliquot parts not only of the whole, but also of all larger divisions, so that the relations of each to all the other parts are seen at a glance. This is a feature of great practical utility.

Now I would like to ask a second question: What possible comparison can there be between a system that permits the employment of the natural method of division and the system that forbids it?

But is not the metric system in universal use by scientific men? No, it is not. Scientific men deal with the extremely great and the extremely small. The former class will have nothing to do with it. The divisions of the circle, as before, continue to be expressed in degrees, minutes and seconds. The minute, measured on the equator, at the level of the sea, is the nautical mile, and this is the unit for astronomical measurements.

That class of scientists who deal with small quantities work within the natural field of the decimal system, and as the metric system was expressed in decimals, while the English system of weights and measures was not so expressed, and as scientists almost always weigh, the use by them of the metric system, expressing weights in decimals of a gramme, was most natural and even necessary, especially as they require a universal system, or language, in which scientists of all nations may communicate with each other. This, it will be observed, is a special use with which no one not engaged in chemical or metallurgical work has any concern.

But because these scientists have found this system admirably suited to their use, they have jumped to the unscientific conclusion that it must be equally well adapted to all uses; than which nothing more illogical can be imagined.

In thus briefly glancing at the great convenient features of the English system of lineal measurement, I must not overlook our wonderful system of scales, nothing comparable with which is possible in the metric system. These, as employed by mechanical draftsmen and architects, are founded on the natural divisions of both the foot and the inch, and on the relations of the foot and the inch to each other. Thus we have ½ of full size, or 6 inches to the foot; ¼, or 3 inches to the foot; ⅛, or 1½ inches to the foot; 1-12, or 1 inch to the foot; 1-16, or ¾ inch to the foot; 1-24, or ½ inch to the foot; 1-32, or ⅜ inch to the foot; 1-48, or ¼ inch to the foot; 1-96, or ⅛ inch to the foot; and so on. These possess the admirable feature of obvious inter-relation already noted.

When an English or American draftsman has to read a French mechanical drawing, and finds the millimeter to be the practical unit, and sees the drawing covered with such figuring as .062 mm., 876 mm., 2.945 mm., he realizes the extreme inconvenience of the single standard, and of using the decimal system for everything, and he thanks his stars that he was not born to such an inheritance as that. Think, too, of the chances of error, from the wrong position of the decimal point, or wrong number of ciphers, and the constant watching against this that is demanded.

I don't know when anything ever appeared to me in such a ludicrous light, as did a bill before Congress, that I first saw a year or two ago, making the exclusive use of the metric system compulsory in the United States, for all purposes whatever; and to read a report of a committee of the House of Representatives, stating that they had procured all possible information on the subject, and the demand for such a measure seemed to be universal; when I don't suppose a dozen engineers or mechanics or manufacturers had ever heard of it. It is hard to treat such a performance seriously. On inquiring who were urging this measure, I learned that they were a number of professors. I might have known this, without asking. It is difficult for busy men to realize that anything so preposterous is really going on.

Fortunately, we don't live under a despotic government, that gives us what it thinks is good for us. If our servants don't suit us, we soon find others who do, and such a law, if enacted, would remain on the statute-book just so long as it would take the people to get it off. But more than that, it would be good for nothing while it was there. The sacred things in this country are, the rights of the individual. Among other things, the right to use the English system of weights and measures is not conferred by statute, and cannot be destroyed by statute. It is our common-law inheritance. There is no power on earth that can take away from a single American carpenter his 2-foot rule.

Firing and Boiler Feeding.

Editors:

Having been criticized, both directly and indirectly, both in "Fireman's Magazine" and "Locomotive Engineering," I feel compelled to vindicate myself, and go deeper into the subject.

A man that did his firing after an old cross-head pump and never fired after an injector, does not realize the excellence of an injector as a boiler feeder.

In by-gone days anything was good enough just so they got along. In the present day the best is none too good. To quote the old saying, "Trifles make perfection, and perfection is no trifle." We cannot expect to reach perfection, but we can strive for it.

If a fireman is pumping an engine he has two temperatures, the firebox and, the boiler temperatures, that he endeavors to work in unison to get the best results. Some firemen can take a poor steamer and by pumping engine so as to lose several inches of water at places where engine is heavily taxed, and increasing the feed at places where work is lighter, will keep up a reasonably satisfactory pressure.

A fireman should, on arriving at the engine and putting in a fire, look ahead, so to speak to the end of the run, and probably by firing the engine a certain way in the beginning will have more steam at the end of the run and a cleaner fire.

And with regard to running an engine. Some men will take the best kind of an engine in good shape and make a very indifferent record. Other men will take any old "scrap" and by paying attention to details, and close observation, make a better record than the man with a good engine.

This brings up the subject of large vs. small nozzles.

Some men will complain about some engine being "no good, all choked up, can't pull her train, can't run, burns too much coal."

Another man will take the same engine and will not only pull the train, but will make up time and consume less coal than the other man.

Some men will run an engine with a nozzle so large that she will not work her fire enough to keep her flues clean one trip. Like Gus' "Dutch wagon" with the large cylinders, he has a large nozzle and nothing to put through it.

Some men pull a train by carrying plenty of steam (100 and enough). Some pull a train with the reverse lever. And some pull them with brains. The same might be said of firemen. Some fire an engine with coal, some with muscle and some with brains.

A. A. LINDLEY.

Oskaloosa, Ia.

Increasing Use of Air Motors for Traction Purposes.

H. K. Porter Co., Pittsburg, are at present installing a compressed air plant for the Mount Carbon Company, Limited, Powellton, W.Va., consisting of compressor, pipe lines, charging stations, etc., together with one 8 x 14-inch Class "B" (four driver) pneumatic locomotive, designed for making round trips from foot of slope to ends of several entries and return. One 10½ x 14-inch Class "C" (six-wheel connected) motor for Cross Creek Coal Company, Drifton, Pa. This motor is provided with large storage and designed for heavy service. One 8 x 14-inch Class "C" (six-wheel connected) motor for the Carbon Coal Company, Greensburg, Pa. Two 7 x 14-inch Class "B" (four-wheel connected) motors for the Mill Creek Company, New Boston, Pa. The storage reservoirs on all these motors are designed to carry 700 pounds pressure per square inch, with the exception of the one for the Cross Creek Coal Company, which is designed for 650 pounds pressure.

In almost every case these orders were secured in direct competition with electric companies, who were figuring on the electric class of haulage. There appears to be an increasing amount of confidence shown in the economies and many advantages to be secured by the use of compressed air for mechanical haulage, as compared with any other system.

After Ideas.

Private advices from the other side inform us that two Germans, whose names were not given, are on their way to this country to visit our leading shops. They profess to be looking after American tools with a view to purchase, but are said, in reality, to be on a tour to secure and copy all the ideas they can find for use in building tools in their own country. We do not, however, feel that there is much to fear, as several tool builders here have told us that they can sell tools in Germany at a lower price, including the duty, than German copies of the same tool.

The leading tool builders of this country do not seem to fear the theft of ideas which can be obtained from a visit to their plant.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Frost Effects in Glass Ornamentation.

Partition doors and windows in passenger cars have long been a fruitful field for the exercise of the esthetic taste of the ornamentor, and this applies more directly perhaps to the glass in the clearstory, or what are more generally known as deck lights.

It is not uncommon to see the most elaborate design traced on the parts named, at no inconsiderable cost, notwithstanding that the pattern is put on the glass by the well-known and cheap sandblast; the item of cost entering into the question in the matter of designing of the patterns to fill certain definite spaces, in the case of a railroad company doing the work. If on the other hand the company orders glass by blueprint showing the size and design, as is done by many roads, the situation is not any smoother, for somebody has to have a profit out of the transaction.

A way has been found to reduce the expense account in the production of ornamental glass for cars, but there is also a reduction in variety of results as well, since there can be only one style of pattern by the process to be described. The general effect is always the same—that of the most beautiful frost work, and with the same utter want of actual duplication seen in frosty figures. Three examples of such effects are shown herewith: Fig. 1 shows a coarse figure, Fig. 2 somewhat finer, and Fig. 3 with a still finer surface. These results are obtained on the glass by first roughening the surface of one side with a brick, as these specimens were, or using the sand blast to dull the surface. Common glue is then applied to the dulled surface with a brush and allowed to dry. The time taken to dry determines the arrangement of figures on the glass. Fig. 3 was dried very quick by the aid of the steam pipes. Fig. 2 was dried slower, and Fig. 1 very slow.

The effect is produced by the glue in peeling off while drying, it taking off a very thin film of glass which adheres to the glue and leaves a striated surface on the glass, a surface that admits light, but is too opaque to distinguish objects through; this is represented in the engravings by the darkened portion. The lighter parts are the spots of the original dulled surface upon which the glue failed to take hold, and this failure to adhere in all parts alike is the key to the always differing style of figures on the glass.

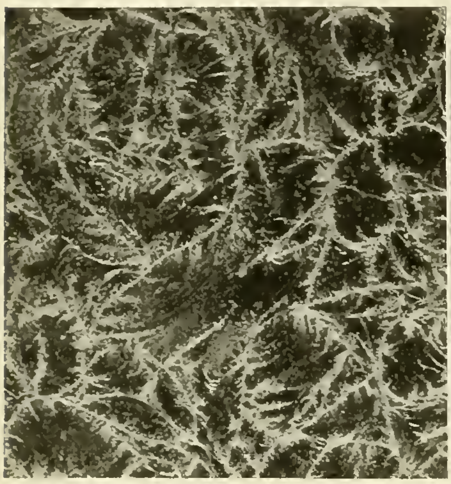


Fig. 2.

Fig. 1.

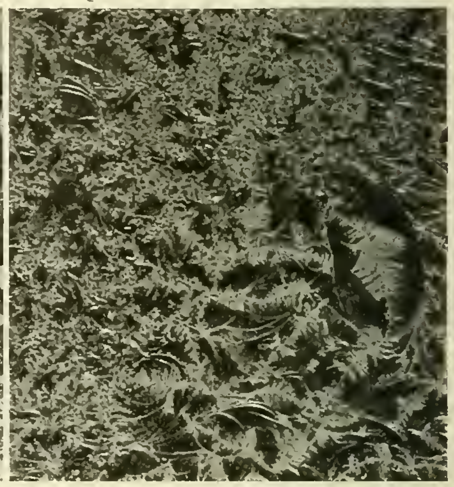


Fig. 3.

From the information available, the discovery of the action of the glue in attacking some portions of the glass and refusing to touch others, and also the peculiar cleavage of the glue in leaving the glass while drying, seems to be more the result of accident than of carefully conducted experiment. The specimens illustrated were obtained from the Middletown shops, of the New York, Ontario & Western Railway, where Superintendent of Motive Power West has long used this method of frosting glass.

Robinson's Improved Diamond Truck.

A little more than a year ago Mr. A. A. Robinson, president of the Mexican Central Railway, designed an improved form of diamond truck with pedestals and provision for placing the spring above the journal box, the same as was done in the trucks used before the diamond came into fashion. A few of the trucks were made and placed under tenders of engines belonging to the Mexican Central Railway. That being about the hardest service to which a truck can be applied, it was considered a thorough test of the durability of Mr. Robinson's invention. The trucks acted so satisfactorily in service that they have been adopted as the standard of the road for tenders and for freight cars.

The Peninsular Car Company are making the truck for 600 new cars, which they are building for the Mexican Central Railway. The truck is no heavier than the ordinary diamond truck, and, as far as we can see, can be built for about the same cost.

President Robinson, the inventor of this truck, is a civil engineer of long experience, and has always taken a good deal of interest in railroad mechanical matters. He was for years vice-president and general manager of the Atchison, Topeka & Santa Fé, and took a keen interest in all shop operations that were carried on in Topeka.

Side Leveler for Permanent Way.

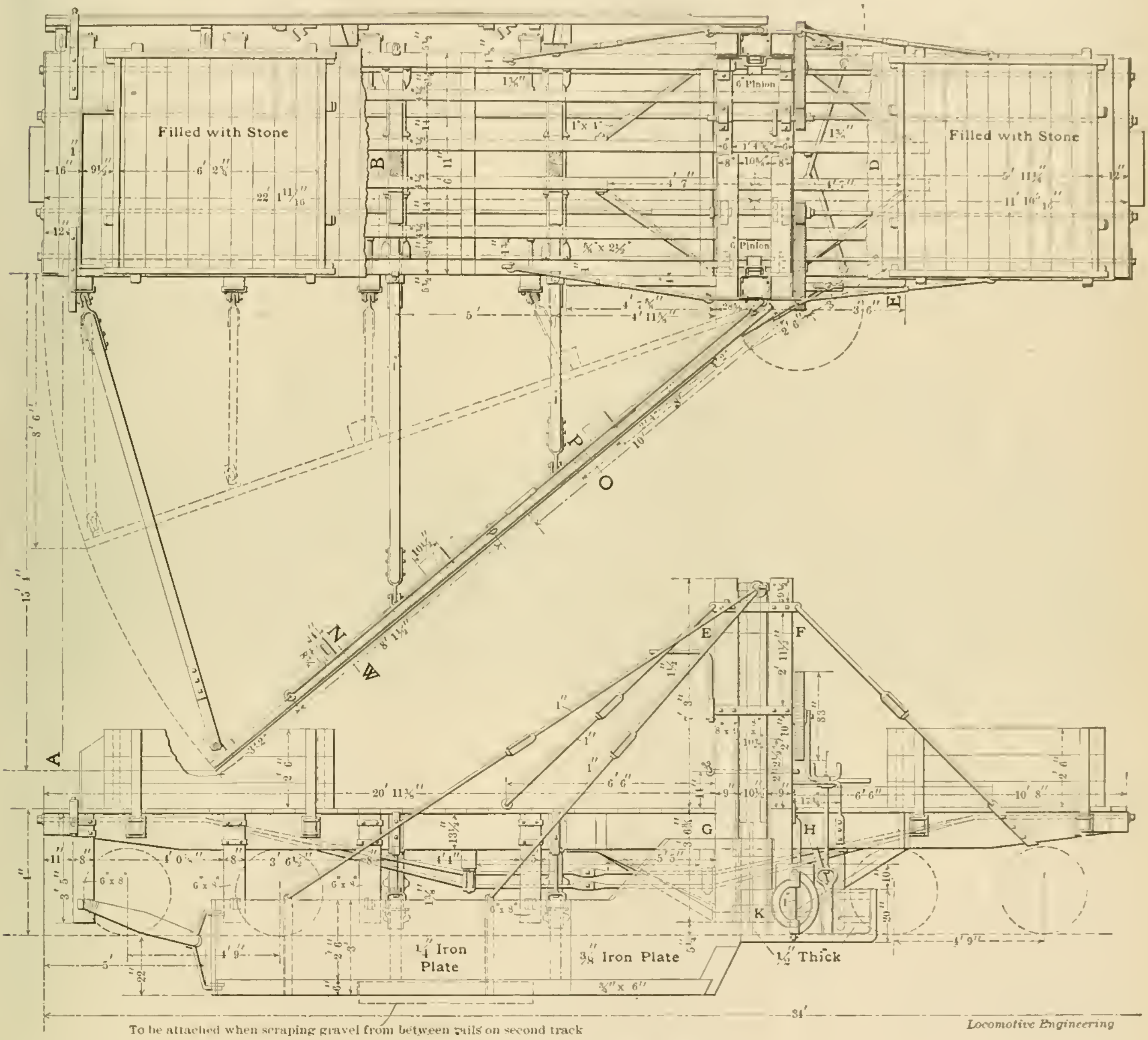
Our illustration of the machine for spreading and profiling the material used in ballasting the tracks, and which has given unmistakable proof of efficiency on several roads in stupendous work of track leveling, will be of interest to those directly concerned in maintenance of way.

It is the invention of a practical railroad man, Mr. O. F. Jordan, of Jackson, Mich., who has worked his way from the ranks to a superintendent's position on the Michigan Central, and who therefore approaches the problems to be solved by the machine, equipped with a full knowledge of its requirements.

The leveling attachments are carried on a flat car 34 feet long over end sills, and 6 feet 11 inches wide over side sills; the narrow width being made necessary by the purposes for which the car was designed. The wings by which the work is done are made of wrought iron, and are rigidly held in position at any angle with the track, or at any depth from 16 inches above rail to 22 inches below. They can be raised or lowered by two men at the cranks, while the machine is in operation, hour, depending on the nature of the material used.

In removing snow from between the tracks on double-track roads, the machine has done some good work. A wing is extended about one or two feet over the outside of the opposite track, and rests on the rails of same; the train running at twenty or more miles an hour, cleans everything down to the tops of rails.

The Illinois Central used one of these levelers in surfacing, while raising their



SIDE LEVELER FOR PERMANENT WAY.

thus giving them a working range that has satisfied all conditions that they have ever had to cope with.

This car can be placed next to the waycar in a gravel or ballast train, and the cars be unloaded by the side or cutter plow, after which the machine is run over the unloaded material with the wings adjusted on either or both sides, spreading and finishing as desired, either higher or lower than the track, and this work can be done at the rate of from 10 to 12 miles an

tracks at Chicago. The Southern Pacific has recently bought one of them, and the Michigan Central has them in operation constantly. Arrangements have been made with the Bay City Industrial Works to manufacture these machines, with the proper wings and accessories for sloping of banks, or for ditching purposes with plow attachments, the intention being to keep it one of the most efficient machines for leveling up earthwork on railroad tracks.

Fluke's Expansion Boring Bar.

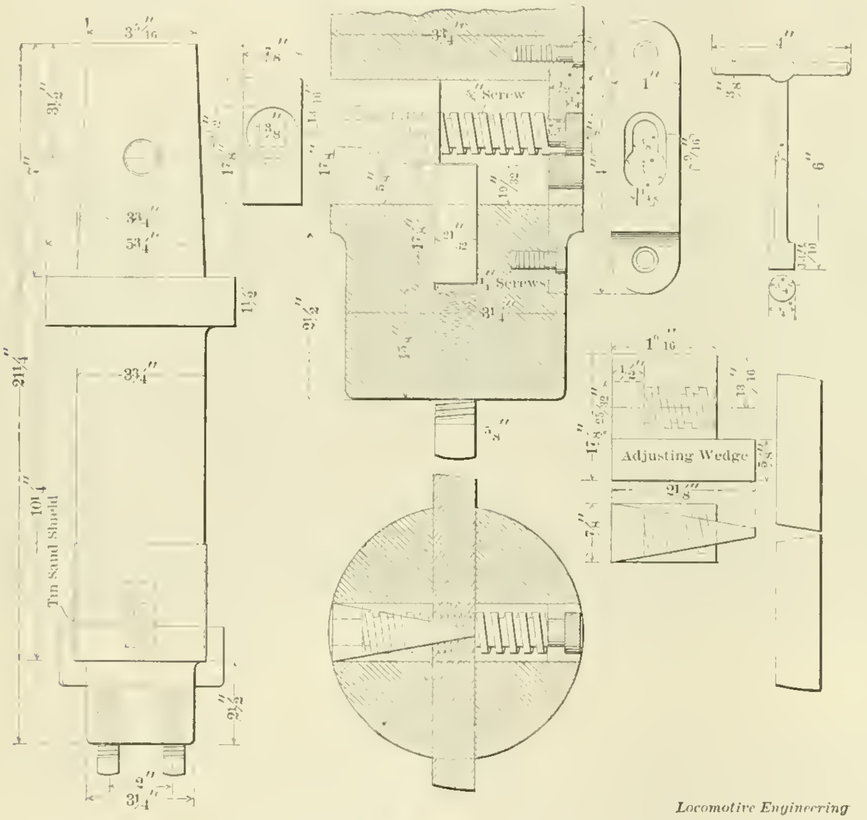
We present herewith a boring bar for use on the car-wheel boring machine, invented and patented by Mr. Fluke, the foreman of the wheel shop of the Louisville & Nashville shops at Covington, Ky. It is the result of an effort to increase the efficiency of the boring machines under his supervision; how successful the effort has been is best shown by the device and its record for fast work.

The improvement over the old order of things lies in the double cutters of the boring bar and the means provided for adjusting them to the cut in the bore of the wheel, which is done by means of a screw that forces a wedge between two cutters of equal length, which advances the cutters an equal amount for any given movement of the screw. The nut for the screw is solid with the wedge, forming the upper part of the latter, both fitting into the slot provided for them in the boring bar. The screw is held in position by a slotted plate let into the bar, into which a collar on the end of the screw engages.

Wheels are roughed and finished at one cut with this bar, not for exhibition purposes, but in everyday service, taking out ⅝ inch of stock, or 5-16 inch on a side, with a feed of ⅛ inch. The average capacity of the machine is 50 wheels per day—60 are on record as 10 hours' work. A peculiarity of practice in the matter of fitting wheels and axles together, is the reversal of the almost universal method of turning the axle to fit the wheel, for all fits are done by boring the wheel to fit the axle—new and old work alike. An advantage, and an important one, in fitting wheels to axles, is that the latter are left at their original diameters at the wheel fit, since it is no longer necessary to turn them; therefore, the life of the axle is increased, or, at least, is not shortened by repeated turnings at a place where strength is required, turnings down to the dust-gûard bearing or collar not being unusual.

The speed of the wheel borer was originally 11 revolutions per minute, but has been increased to 18 revolutions as a part of the program of reform in the wheel shop. This is equal to a speed of 25 feet per minute, and closely approaches contract shop figures; but we believe railroad shops are not used to this sort of thing, in general.

As an evidence of the popularity of the expansion boring bar, we will say that there are thirteen prominent roads now using it.



EXPANSION BORING BAR.

Master Car Builders' Convention.

The convention of the Master Car Builders' Association for 1897, opened with one of the largest assemblages in its history, first listening to an invocation for divine guidance, by the Rev. W. F. Sheppard. The address of welcome by Col. Royal T. Frank, the commander of the post at Fortress Monroe, was so full of genuine hearty good will that all feeling of restraint quickly vanished before his well rounded periods in extending the freedom of the place to the visitors.

Governor O'Ferrall, Virginia's chief executive, was next introduced, and made one of his most masterly and entertaining speeches, in which he referred to the equipment and cost of operating railroads in a manner that evinced a knowledge of the technics of the subject, little expected of a man who has devoted his life to the dry teachings of a Blackstone or the dusty precepts formulated by a Coke. Full of patriotism was the flowing eloquence of the Governor, proving that Virginia, the home of the immortal Patrick Henry, is still the birth-place of the most gifted orators of our fair land. His cordial welcome to the "Old Dominion," the cradle of our liberty—for it was the Virginia delegates that proposed the Declaration of Independence to the Continental Congress in 1776, and it was she that has seven times sent her sons to occupy the presidential chair—stirred the hearts of everyone present to quicker action.

President Crone, in his address, reviewed the business situation of the year passed since the last convention and dwelt on the lessons conveyed in the depression then and still present. His recommendations for action were replete with healthy suggestion, no phase of car construction or its needs being omitted.

PROCEEDINGS OF FIRST DAY.

The report of the secretary showed 256 active members, 179 representative members and 5 associate members; a total membership of 440. The report of the treasurer showed a balance of $6,096.23. A motion by Mr. Mackenzie that the dues for 1897 be remitted was withdrawn on explanation by the secretary that the surplus would be likely to fade into nothingness with the prospective expenses of the year in view.

In the topical discussion, the question of hanging brake beams on four-wheeled passenger trucks, whether outside or inside, was opened by A. E. Mitchell, who stated that his road (the Erie) had ordered four passenger cars with inside hung brakes. This method had been in use some time on the Canadian Pacific, at first with 96 per cent. braking power, and slid wheels were the result; after the braking power had been reduced to 90 per cent. the work was highly satisfactory.

The advantages and disadvantages of methods of wheel mounting was opened by Mr. Barr, who advocated the M. C. B. gage, which gages from the inside of one flange to the gage line on the opposite wheel. The committee on standard wheel and track gages were offered a portion of the Muskingum Valley Road by Mr. Potter, to make such tests as they deemed advisable. Mr. Potter, on motion, was made a member of the committee.

Mr. R. H. Soule opened the subject of journal box lids, and an experience meeting was indulged in by the members; defective covers getting one of their periodical overhaulings in the talk that followed. A number of practical devices were described, but we will hazard the statement that the same old time-killer will be up for discussion in the years to come. There are good designs of covers to be had—plenty of them—but failure of recognition would seem to imply a determination on the part of those who need them, to avoid their use, for the purpose of keeping the subject before the association.

Supervision of standards and recommended practice was a voluminous subject, fairly reeking with changes in present practice, which is certainly a sign of progress. Mr. Mendenhall reported that owing to the inequalities of cored holes in coupler shanks, he would recommend that the standard of 1895 be continued, and the spring yoke still have the lipped end on account of imperfect rivets. Objection was raised to the portion of the report referring to the turned over ends of the yoke and a spirited debate followed. Lip or no lip was the slogan.

PROCEEDINGS OF SECOND DAY.

Turned down ends on spring yokes was the first subject under fire on the opening at 9 A. M. Mr. Rhodes desired to have the lugs omitted and opened the row with that proposition. Mr. Mitchell and others took the ground that they were cheaper to make and maintain, presenting figures of cost to prove their contention. Mr. Waite took the position that turned over ends were necessary on yokes, and presented many good reasons for his belief. Mr. Garstang and Mr. Morris were in favor of continuance of the lugs, while Mr. Hennessy went on record that they were no good. The question was put to a *viva voce* vote, and Mr. Rhodes' motion to eliminate the lug from yoke construction was lost.

In amendment of the rules of interchange, a slight change in the wording of the preface was, after a warm bout between the gladiators, adopted. The words "made by them" being introduced after the word "repairs."

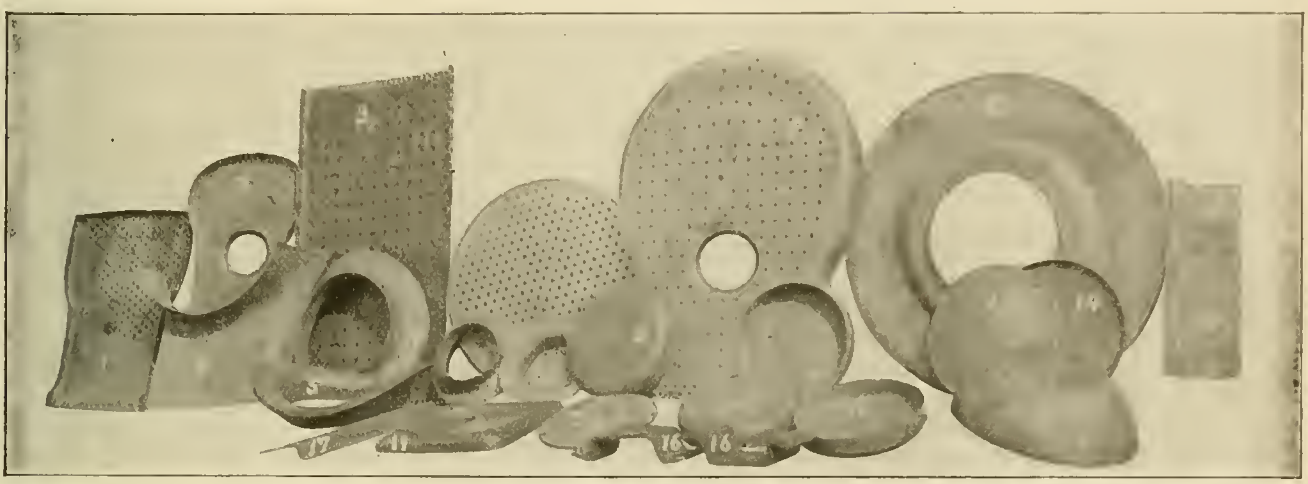
same section was then amended to read so as to make owners responsible for axles on cars which are not stenciled.

In the consideration of the use of repair cards, Mr. Barr made a good point when he stated the false position in which officials were placed by the failure of inspectors to render card for work done, and particularly enjoined that inspectors should be educated up to the point of proper discrimination in billing for defects. Mr. Rhodes also came near the center of the target when he impressed the members with the importance of assisting the inspectors to be in close touch with all arbitration proceedings, and also all action taken by the association referring to interchange; enlarging on the advantages to railroads by a proper education of the men who decide what cars shall or shall not pass their roads. Mr. Booth, the general auditor of the Baltimore & Ohio Ry., addressed the members on the subject of interchange, he representing a general committee consisting of the auditor of the C. & O., the superintendent of motive power of the Big Four, the superintendent of motive power of the Erie, and the superintendent of motive power of the United Railroads of N. J. The motive power officers acting in conjunction with the auditing officers, to reach a unanimous and clear method of handling claims with the accompaniment of the voluminous mass of documents now considered necessary to straighten out a 15 cent claim at an expenditure of as many dollars.

the price of labor and material between the East and West. The proposal made somewhat of a commotion among the war horses of the association, but a vote put a quietus on the protective tariff urged by the Western member. The report of the committee appointed to revise prices on interchange work was then adopted, winding up the work of the arbitration committee, who were commended for their work of the year by a unanimous vote.

Rules for loading timbers were referred to letter ballot for recommended practice, and the committee on trains parting was continued for another year, to give them an opportunity for observation of the working of their recommendations. This action was taken in accordance with the suggestion of Mr. Leeds.

When the matter of specification and guarantee of cast wheels came up, Mr. Barr presented one of the best reports read during the session. Clear to a degree. Full to the least important detail, as was expected from an authority on wheels. Long, maybe, but there is room for very little pruning in it; and it will stand as the best document of the kind that we have had. A motion that, in the physical test, one wheel be subjected to the drop, and one wheel be subjected to the thermal test, passed without opposition.



WORK DONE BY HYDRAULIC PRESS IN SCHENECTADY LOCOMOTIVE WORKS.

The Denver Railway Club made an attempt by a communication to have a definite depth named by the association for hollow wear on treads of wheels, naming $\frac{5}{32}$ inch as the depth meeting their views, but the stated depth was thought by the association to be impracticable to measure, and would therefore cause the same degree of uncertainty among inspectors as the present section 7, which will be conceded to be somewhat vague and uncertain. The personal equation of each inspector will govern in the question of what will render the flange or rim liable to breakage. The Denver proposition was lost when put to vote.

In section 15, the question of amount of wear of collars was handled with a rising temperature; the words "worn off" being the bone of contention. The hard work of the orators was brought to a standstill by the motion to accept the report of the arbitration committee for the wording "worn out," which was passed. A reconsideration of this vote was then moved by Mr. Simons, and lost. The

PROCEEDINGS OF THIRD DAY.

The committee appointed to rearrange and revise prices for interchange work, reported to the effect that the prices of 1896 were as nearly satisfactory as any they could name, with some minor exceptions. A surprise was sprung in the convention by Mr. Humphrey, of the Colorado Midland, who proposed that an allowance of 10 per cent. be made on work done at points west of the 105th meridian, in order to cover the difference in

The subject of adoption of a standard coil spring for freight cars, and the best basis for selection of same, was introduced by R. P. C. Sanderson, who read an interesting paper on the theme. It was referred to the committee on subjects for action.

Copper sheathing for passenger cars, its application and advantages, was a subject introduced by Mr. Appleyard, who explained how he fitted up some passenger cars. These cars have had a service of about five months without interruption, and no change in appearance up to the present time. The cost of the copper sheathing is about $50 more per car than that of the wood with its paint and varnish. The principal saving is in the decreased shop room required by the new process, since it can be put on out of doors if necessary, and is ready for service at once. A sample of the finish made an interesting study, and was eagerly inspected by the members.

Mr. Schroyer presented a paper on the practicability of the establishment of a test laboratory or bureau for railway companies, and gave some excellent reasons on the affirmative side of the case. Mr. Sanderson also read an interesting paper in advocacy of such practice, and outlined a rational procedure for any plant, large or small. Mr. Rhodes took the floor and gave some cogent reasons why a familiarity with laboratory work would be beneficial to the members of the association, and cited the matter of spring yokes without lugs (under the mantle of one of his beneficent smiles) as a lively object lesson in favor of the physical laboratory. The negative, in the person of Mr. Johnson, a veteran in car service, made an attempt, in a brilliant forensic effort, to disprove the value of the laboratory in railroad work, but his well-meant efforts were powerless to cause the members to waver in their loyalty to theory as exemplified in the testing machine when coupled to their practical knowledge.

PROCEEDINGS OF FOURTH DAY.

Report of the committee on improved freight car buffers was read by Mr. Brazier, and was full of figures to show the uselessness of the ordinary buffer. Mr. Rhodes read a paper covering the same subject more clearly, and going into the details of spring compression for different speeds, which made a valuable contribution to the literature of draft springs. Mr. Waite in a few remarks pointed out the evils of placing buffers below the center line of sills, showing that the practice was largely the cause of breaking sills at the bolsters, and in conclusion stated that buffer blocks needed regulating.

The report of the committee on arch bars and column bolts, read by Mr. Simons, was a paper well put together, and touched intelligently on the live points of the arch bar truck, giving the radical lines of difference and pointing out many of the difficulties in reaching a standard. The report was ordered sent out for action by letter ballot.

Considerable talk ensued over the report of the committee appointed to present individual designs for steel under framing for freight cars. The committee seemed to be a unit in their desire to be released and have a new committee appointed. A motion to that effect prevailed. Mr. Sanderson, one of the retired committee, read a paper giving his views, in which he stated that the car submitted by him in 1896 had been re-calculated, with the result that it had been brought to a less weight than a wooden car of the same capacity, and this had been brought about without any sacrifice of strength in construction. Mr. Joughins, another member of the retired committee, called attention to his steel car on exhibition, giving a few facts of interest, during which he said that the car after 4½ years of service had not required the expenditure of one cent for repairs, and but for the need of paint would be taken for a new car. This was the first one of the steel cars made by Mr. Joughins and was thought by him and all that saw it to bear the best evidence in favor of steel car construction. It was through his earnest appeal that a new committee was appointed to prevent loss of interest in a subject that should not suffer an unnatural demise. He asked earnestly for an expression of opinion from the members, and invited those who were not favorable to steel cars to state their reasons frankly so that the new committee might be enabled to meet all objections and cope with them fairly and intelligently.

In the topical discussion of the questions "Is it safe and advisable to splice air-brake hose, and should such hose be condemned in interchange?" Mr. Rhodes opened the subject with an array of data that carried conviction for his contention in the affirmative. The cost of a splice was 7½ cents, while the cost of a new hose was $7.50; the splice thus showing up with a vengeance on the side of economy in air-brake fittings, consisted simply of an ordinary nipple secured to the two sections of hose by the common hose clamps, for a hose that is defective and requires splicing. A vote on the question gave the approval of the association to splicing of hose.

The question of advantages likely to accrue from the adopting of a defect card to be used on couplers did not get the approval of the convention. Mr. Miller did not believe in too many defect cards, and gave the practice of his road in reaching the truth without the assistance of a card. Satisfactory results were had by simply making it compulsory on the part of conductors and superintendents to report all shortcomings or failures of couplers, and it was believed that every such case was promptly reported to the machinery department. Mr. McKenzie went further into detail of the causes of coupler failures, and showed conclusively that couplers would fail, and that too unexpectedly.

Air-brake hose specifications came up for attention in the question, "Is heavy four-ply hose better than two or three-ply hose of equal diameter but having greater pliability?" Mr. Waite gave some interesting particulars of a physical test to determine the frictional resistance between the layers of two-ply hose, in which an ordinary spring balance was used to pull the layers apart and thus measure the resistance in pounds. The members paid a nice compliment to the above in their personal indorsement of his practical expose of rotten hose. Mr. Barr was of the opinion that a demand for a factor of safety of 10 for hose looked much like straining the point when the safety margin on a car was only 3 or 4, and he assured the convention that a test pressure of 900 pounds on air-brake hose was not only unnecessary but ridiculous. Mr. Carson also gave some facts in the connection, showing that elasticity was a prime factor in the strength and life of hose. Tests made under pressure by him demonstrated that while hose would stand the required internal pressure they would invariably fail quickly for want of sufficient elasticity.

The election of the old roster of officers for the ensuing year, closed one of the best attended, pleasantest and we believe one of the most profitable sessions in point of results ever held by the association.

100,000-Pound Steel Car.

There has been a great deal of interest manifested in this country in the subject of steel cars for several years past, and occasionally a steel car has been built. The subject has also been discussed very extensively by the Master Car Builders' and Master Mechanics' Associations and various railway clubs.

The first substantial movement, however, toward the introduction of steel as a factor in car construction has just been inaugurated by the Pittsburg, Bessemer & Lake Erie Railroad Company, who are having built by the Schoen Pressed Steel Company, 600 steel cars of 100,000 pounds capacity. Two of these cars, designed by Mr. Charles T. Shoen, have been on exhibition at the Master Car Builders' and Master Mechanics' Conventions, at Fortress Monroe, during their recent sessions, and they were examined with great interest by the members. Our half-tone gives a very good idea of their appearance.

Three amongst the many remarkable points about these cars are:

1st. The very light weight (34,000 pounds) of the structure when its carrying capacity is taken into consideration, as compared with the weight of the ordinary car commonly used, composed principally of wood. This light weight is obviously a large and continuous source of economy in transportation.

2d. The symmetry and simplicity of construction. This was remarked by all who viewed them. These points in this particular design of car were effected by the innovation of the designer upon the old practice of designing metal structures. Instead of using rolled sections, such as channels, eye-beams and angles, as is the common practice among all structural engineers, he has resorted to the use of pressed steel shapes entirely, taking steel plate and pressing it into theoretically the correct shape to obtain the greatest possible strength with the least possible weight—for example, as is shown in the sills composing the under framing of the car. The sills are 17 inches deep at the center, and 10 inches deep at the ends of channel section. A channel made in this way is just as strong for resisting strains as though it were 17 inches deep throughout its entire length, and the saving of probably 30 per cent. in the dead weight to be carried is effected.

This idea has been followed throughout the entire structure, with the result that, it is estimated, a saving of about 4,000 pounds is gained over the practice of using rolled sections, and probably 6,000 or 7,000 pounds is gained over the use of wooden structures of equal capacity.

3d. A great reduction in the number of parts is also effected by this design—for example, the side sheeting is all one piece and flanged at top and bottom, thus avoiding the necessity of riveting angles around these points. The floor sheeting is flanged on the edges, making only one row of rivets necessary, instead of two rows, as would be the case were the floor attached with angles to the sides; and so on through the entire structure, this idea has been carried out, so that the riveting required is only about two-thirds of what would be required where the structure is designed of rolled sections. This reduction of parts is quite a feature, aside from the other advantages, because experience has demonstrated that it is one of the greatest sources of economy in the maintenance of rolling equipment.

The construction may be outlined as follows: It consists of four sills 10 inches deep at the ends, and gradually increasing to 17 inches at the center where the greater strength is required. The sides are made of one sheet of steel, flanged at the top and bottom. The bottom flange is thoroughly well riveted with the top flange on the side sill, so that the entire side of the car may be considered as a girder.

To the center sills are riveted two longitudinal hoods and one transverse hood, which also adds very materially to their strength. In this particular type of car, the body bolster has been placed on the top of the sills, which is quite an advantage, as it reduces the hight of the car from the top of the rail considerably. This body bolster is made of a rectangular piece of steel. The surplus metal, owing to the bolster being deeper at the center than at the ends, forms a very good gusset plate, which is riveted to the flanges of the side sill and side sheeting. A flange is also turned up on the ends of the bolster, and is riveted to the side sheeting, which is reinforced by a rectangular plate on the outside 1/2 inch thick. In addition to this, the bolster is braced and tied to the sill by triangular-shaped brackets.

The end sill of the car is pressed out of one sheet of steel, reinforced by gusset plates, which are riveted to it and the main sills of the car.

The car is tied together by a transverse hood and hoppers. It is equipped with the Westinghouse friction draft and buffing device. The axles have 5 x 9-inch journals, and have about three per cent. nickel in them, rendering them exceedingly tough and strong.

It is probable that these 600 cars will be watched with more interest than any like number ever built.

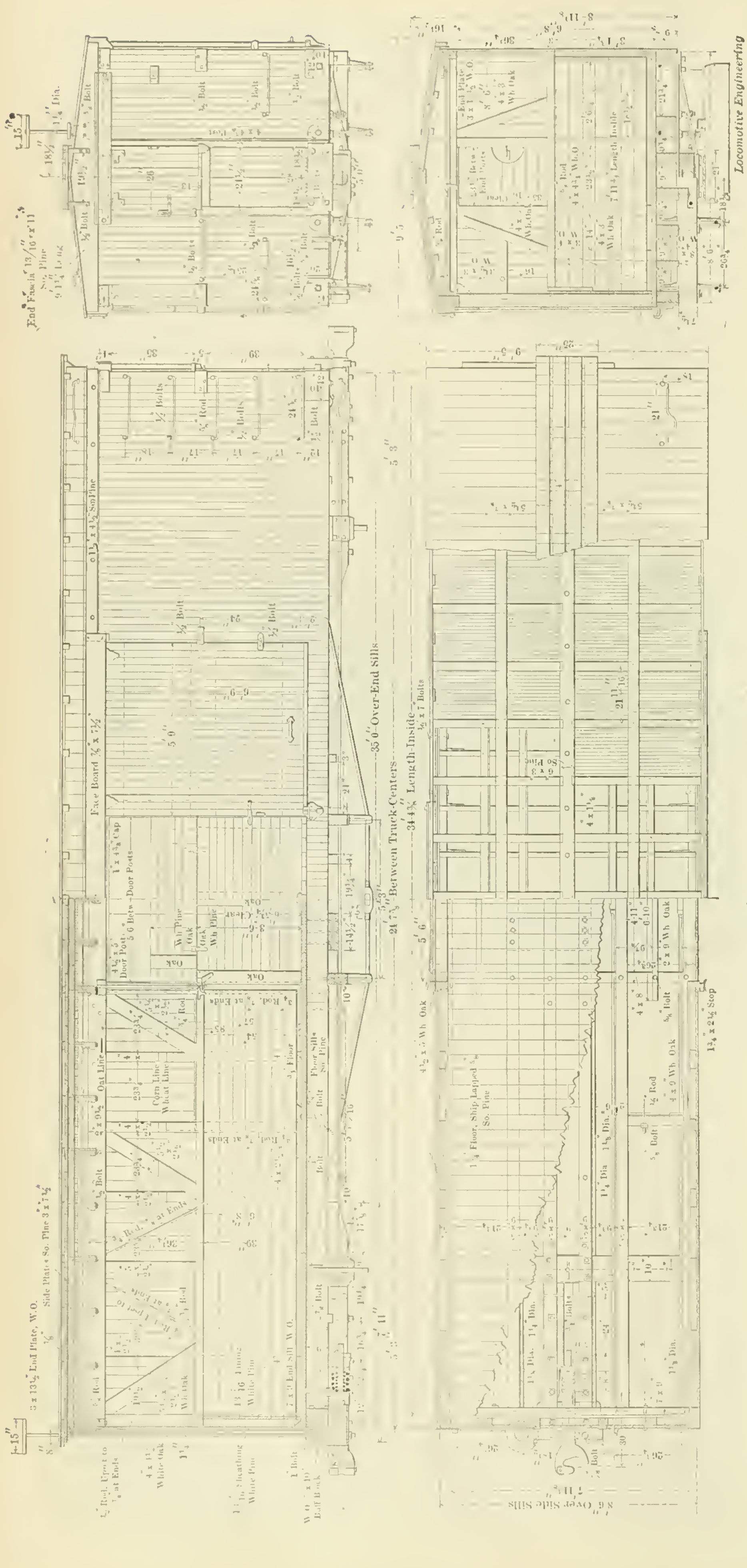
100,000-POUND STEEL CAR.

Illinois Central 60,000-Pound Box Car.

Our line engraving of the standard 60,000-pound car, of the Illinois Central Railway is published by courtesy of Assistant Superintendent of Machinery Brazier. This car stands as a representative of the best practice in wooden construction, and while there are no startling innovations in its make-up, it will pay for an examination by those who are interested in a mechanical production showing practice which is the result of thought based on experience.

The car is 35 feet long over end sills, and 8 feet 6 inches wide over side sills, 34 feet 4 3/8 inches long inside, 7 feet 11 3/8 inches wide inside, and 6 feet 10 1/4 inches clear hight inside. These dimensions give 1,872 cubic feet of space available for load, making the car come well within the lines of most of cars of its nominal capacity, and leaving it off of the list of the big ones with their surplus of avoirdupois per pound of hauling capacity.

All six longitudinal sills are 5 x 9 inches, and end sills are 7 x 9 inches. The



ILLINOIS CENTRAL 60,000-POUND BOX CAR.

corner posts are 4½ inches square, the side door posts 4½ x 5 inches, the end posts 4 x 4¾ inches, and the side posts 4 x 2½ inches. The side braces are 5½ x 2½ inches and the end braces are 4 x 3 inches. All these dimensions show a remarkable liberality in material where needed, and that material of the best kind for the service, white oak, except in case of the long sills, which are of southern pine.

The body is well braced with ¾-inch diagonal rods over the bolsters, and well supplied with framing rods at the door posts and second panels as well as at the end posts. The four long truss rods are 1⅛ inches on the body and have the ends enlarged to 1⅜ inches diameter. Corner plates inside and out furnish the staying at those points, the plates being fastened to the body by button head bolts with heads on the inside; the plates at the girths forming a washer for a rod that extends back to the post over the body bolster, forming a very efficent tie at the four corners of the car at a point half way between the sills and plates. The end doors are provided with locks, both inside and outside, the latter for seal and the former simply a latch.

An especially strong draft rigging is seen on these cars, the draft timbers passing through the body bolsters and abutting against the 4 x 5 inch filling pieces that extend to and between the cross-tie timbers, thus greatly assisting to eliminate the danger of breaking the sills at the bolsters, a too common occurrence in all cases where the center line of buffing does not coincide with center line of sills. The American continuous draw-bar is used in this connection, the whole giving highly commendable results. The record given by these cars up to this writing has been such as to satisfy the designers that there is not much of an opening for improvement in the wooden construction as far as concerns their service.

Partially Broken Staybolts.

Mr. T. A. Lawes, superintendent of motive power, of the Chicago & Eastern Illinois, having been assigned the duty of opening a topical discussion on Broken Staybolts, at the Master Mechanics' Convention, said:

"I shall be pleased to present to you a few thoughts on the subject of 'Partially Broken Staybolts,' which in my opinion is a topic of much greater importance, since partially broken staybolts are the more difficult to detect. In fact, so far as my investigation goes, they are never detected under the old methods, and must be regarded with suspicion.

For some years hollow staybolts and drilled staybolts have been used to a limited extent, but for some reason—or no reason— neither one has been put into general use, although, as I believe, the protection afforded is invaluable.

To satisfy myself as to an inspector's ability to detect broken and partially broken staybolts, I have had the staybolts in thirteen engines drilled during the past year. The plan adopted was to have the inspector locate all the broken staybolts he could find, after which the staybolts in the firebox were drilled, including those marked by the inspector as broken. In the first firebox tested in this manner the inspector found thirty-nine broken staybolts. After drilling and testing under water pressure these were all found broken, and in addition to these we found fifty-nine others broken which the inspector was unable to detect by the hammer test. This surprising result led me to examine the broken staybolts critically and I find that those detected by the hammer test were broken entirely off, while those found by drilling holes in the ends, were only partially broken off.

After testing the staybolts in twelve fireboxes and finding the ratio of broken staybolts and partially broken staybolts about the same as in the first firebox tested, I concluded to try the method of testing under boiler pressure and having a helper hold on while the inspector gave the hammer test, but with no better results.

I desire now to direct your particular attention to the thirteenth and last firebox tested for broken and partially broken staybolts by the two methods. I consider it the most severe comparative test of all, from the fact that three inspectors in turn, did their level best to locate broken and partially broken staybolts by the hammer test; they having been informed that the staybolts were to be drilled after they were through with their inspection. They were given all the time they required to make a careful and accurate inspection. The result was that the hammer test located four broken staybolts and the drilling test discovered forty-six partially broken.

A careful record of the broken and partially broken bolts detected in thirteen engines shows that 440 were discovered by the hammer test and 619 by the drilling test.

To me these facts are conclusive evidence that partially broken staybolts cannot be detected by the hammer test, and I believe a great risk is run by either not drilling the ends or not using hollow staybolts, and that either of these precautions will prevent many boiler explosions with the usual verdict of 'Cause of explosion unknown.'

There have been more boiler explosions in recent years caused by broken staybolts than ever before. I attribute this to the fact that a much higher pressure is carried. Too great precaution cannot be taken to prevent loss of life and destruction of property and my experience leads me to recommend that every staybolt used should be either hollow or drilled—making it self-detecting.

The expense of the precautions here recommended should not stand in the way of preventing boiler explosions due to defective staybolts, as the cost for drilling is only about $3.75 for a fire-box containing 900 staybolts. I figure that the cost is only an apparent one.

For example: If the 619 partially broken staybolts had not been drilled and tested in the thirteen fire-boxes referred to above, these partially broken staybolts in time would have become broken staybolts and the engines containing them would have had to be laid up—possibly when needed badly—for the removal of broken staybolts, which would have necessitated the removal of jackets, air brakes, pumps, frame angle iron and other parts covering the staybolts, thus causing an additional expense over that, if properly attended to in the shop while undergoing repairs.

It is my practice to turn engines out of shop with staybolts beyond suspicion, and I find that I have no trouble with them afterwards. I recommend to such members of the association that do not use hollow or drilled staybolts that they drill the staybolts in a few fireboxes as described and keep a record of the number found by the hammer test and by drilling them, and I am sure that they will be surprised at the results."

An Unreasonable Drummer.

The following anecdote illustrates at once the impractical character of the home grown Irishman, his abandoned love for a political argument, and the free and easy ways of Irish railroads. In Ireland where every man is a politician, and usually a warm one at that, business not unfrequently plays second fiddle to politics.

Some years ago, about the time when one of the periodic splits in the Irish parliamentary party occurred, an English drummer found himself stuck at Ennis, in County Clare. The train was timed to leave at 10 o'clock and he took his seat at that hour. Half an hour passed and there being no appearance of starting, he began prospecting about for a reason. The station-master, engine-driver and guard were discovered in the midst of a heated discussion on the political split question. Our drummer interfered and suggested starting the train.

"Arrah! go along wid you," said the guard, "Shure, man, don't you see we're busy." And he resumed the argument. After an hour had passed, by means of continual interruption and expostulation, our drummer got them to draw out. But they didn't go far. Ten miles out of Ennis the train stopped in the midst of a wilderness, the engine uncoupled, and steamed away ahead in charge of the fireman. Then the engine-driver came back, the guard came forward, a few cattle dealers and pig-jobbers got out, and, beside the carriage in which the drummer was seated, they all sat down on the embankment, lit their pipes, and resumed the discussion. The drummer lost patience, and made a sultry enquiry at the guard as to the cause of the stoppage.

"Arrah! who but yourself is the cause of it?" answered the guard indignantly. "You were in such a hell of a hurry to leave Ennis that we came away widout anny wather, and the engine has gone on to get some."

A correspondent, says the "Locomotive," sends us the following unholy story about a Wisconsin farmer's correspondence with a boiler maker. It was taken, we believe, from the Syracuse "Standard:" "The farmer wrote as follows: 'Dere Sirs, I hav 1,000 akers of trees that I want cut. I'm pore, but I am willing to pay too hundred dolers fer an engin that will do my work,' and he went on to explain just what sort of an engine he wanted. The boiler firm saw that the machinery necessary to accomplish the devastation of his virginal forest would cost $3,000, and they wrote him to that effect. A week passed, and then the following pithy epistle came back from the Wisconsin woods: 'Dere Sirs, what in hqxl wud I want of a biler if I hed $3,000?' "

The M. C. B. Pressed Steel Brake Shoe Key, formerly manufactured by the Drexel people, but now by The Q & C Co., has been very much improved, being strengthened at the point subjected to severest strain. With the new improvement, the only objection raised to the pressed steel key has been removed, and while this key is now very much lighter than forged key, it is strong and elastic, being made of a very fine grade of pressed steel. In addition to making the improvement mentioned, the manufacturers have greatly reduced the price so that these goods are much cheaper than many of the inferior keys now being offered.

We had a visit lately from an engineer who has been for some time running on the railways in South America. He ran a Rogers' compound in Peru and he spoke highly about its economical performance. Some of the railroad men in that country have peculiar ideas concerning the economical operation of railroads. Our visitor said that they took the strips off all the slide valves on the plea that a locomotive ought to have as few pieces as possible.

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Large Cylinder Clearance Spaces.

For the last few years our designers of locomotives have been imitating stationary-engine and marine-engine practice in the proportioning of steam ports and passages. Before cylinders came to be so large as they generally are in modern locomotives, there was a recognized rule among designers to make the steam ports 1 inch smaller than the diameter of the cylinder, and a fairly efficient and economical engine was produced under that practice. But with the latter-day idea of following the lead of our best automatic engine designers, the ports are made as long or longer than the diameter of the cylinder, with the result that the modern locomotive is far from being an economical steam engine.

It may be regarded as engineering heresy to say that the advance in forms and proportions that have admittedly improved stationary and marine engines to such an extent that it is by no means uncommon to obtain work at the rate of one horse-power per hour for 1½ pounds of coal, is not the proper line of progress to pursue in locomotive engineering; but we venture to take that heretical position. Practice which is unquestionably good for stationary engines may be entirely wrong for locomotives because the conditions of operating are essentially different in many respects. Experience has demonstrated the truth of this at various times.

Builders of stationary engines design their steam ports and passages with the view of getting the steam into the cylinders as near to boiler pressure as possible; but they take good care to keep the piston clearances and spaces between the valve and piston as small as circumstances will admit of. With the short direct steam passages practicable in stationary and marine engines, the total clearance space between valve and piston can be made a very small percentage of the total piston displacement. In this respect builders of these engines have a great advantage over locomotive designers.

Those who do not make their clearance spaces very small for stationary engines have one important advantage which locomotive designers do not enjoy. The losses incident to large piston clearance can be to some extent regained by compressing the steam left in the cylinder, so that it shall reach initial steam pressure when the steam port begins to open for admission. According to Rankin, the whole of the losses due to piston clearance can be won back by compression, and his theory has done much to lead many engineers into the belief that large clearance was not a practice likely to cause waste of steam. While it is difficult to refute the theories of Rankin on this question, experience and experimental tests have not corroborated his teaching.

In stationary engine operating, compression may be employed to the best advantage, because the exact degree of pressure may be regulated with considerable exactness since the size of outlet for the exhaust steam is always constant. This cannot be regulated closely with locomotives, because the size of the exhaust nozzle regulates, to a great extent, the amount of back pressure in the cylinders. If it were possible to keep the exhaust nozzle of uniform size, the variations in speed and work done would render it impracticable to regulate the back pressure so that there would be a constant volume of gas left in the cylinder when the valve closed for compression. But it is not possible to keep the exhaust nozzles of a locomotive of constant size.

Gumming of the inside surface is constantly varying the size of the nozzle, and bad coal often demands that smaller tips shall be employed. When these changes are made, the reduced opening increases the back cylinder pressure. Where attempts have been made to regulate compression in locomotives, so that it should rise to steam-chest pressure before port opening began, the causes referred to have forced the compression line so high that the valve got lifted off its seat, and the piston met with so much resistance before the stroke was completed that the engine worked against itself.

This experience has been gone through repeatedly and the practical effect of the lesson received is that designers keep the compression as low as possible consistent with the cranks passing the centers without pounding. This practice produces a smooth working engine, but with the large steam ports and passages in vogue the waste of steam must be very great.

There is another source of waste incident to the use of very large steam passages. Owing to the exposed position of the cylinders and steam passages of a locomotive, the engine necessarily suffers much from cylinder condensation. That is, the steam passes over cooling surfaces from the instant it emerges from the steam pipe and all those cool surfaces act as steam condensers. The huge passages in the saddle begin the condensing process and send damp steam to enter the cool cylinder. Only those who are familiar with Tyndall's experiments showing the amazing heat devouring capacity of aqueous vapor can realize the pernicious effect that results from condensing part of the steam before it reaches the cylinders.

That ordinary steam engine practice was not always a safe guide for locomotive engineering has been demonstrated in regard to the throttling of steam. The theory has long been disseminated that steam should be passed from the boiler to the piston with the least possible restriction. This is undoubtedly a wise principle in the operating of ordinary engines, but its utility when applied to locomotives is very doubtful. With recent progress of steam engineering into railroad circles come the demand that locomotives should be run at all times possible with the throttle wide open, the power to be regulated by the reverse lever. Intelligent engineers insisted that under certain circumstances the practice of running with the throttle wide open caused waste of steam, and made a hard riding engine, but their views were treated as the expressions of prejudice and "keep the throttle wide open" became the watchword of progress. Motive power officers were rapidly making that a hard and fast rule when Chas. T. Porter, the celebrated mechanical engineer, read a paper before the American Society of Mechanical Engineers giving particulars of experiments which demonstrated that under certain circumstances throttling saved steam. Experiments made by Professor Goss on the locomotive Schenectady at Purdue University have sustained the position taken by Mr. Porter and the more intelligent locomotive engineers and it now seems in order to modify the rules as to the use of wide open throttle.

When the theory that large ports and clearance spaces produce the best form of locomotive is reduced to the rigid test of accurate experiment, we are persuaded that our designers will learn that they have fallen into a fallacy which has been very costly to railroad companies.

Trying to Cheat Nature.

Americans are rightly proud of their public-school system, which enables the children of the poorest members of a community to receive an education which will enable them to grace the highest position of the land, if it is properly followed up by continued studies. There is one department of knowledge, however, in which most of our people are decidedly deficient, and that is, those principles of nature known as the laws of natural philospophy. We have a greater percentage of mechanics and artisans than any other nation, except Great Britain, yet the teaching of our public schools appears to be based on the idea that all the youths are starting on their way to becoming lawyers, doctors or ministers. This seems to be the reason why any mechanical monstrosity, if thoroughly advertised, will find many people ready to spend their hard earnings to purchase an interest in the thing.

What many of our people are greatly in need of is a realizing sense of the fact that no machine can ever be invented that will give out the whole of the effort that has been expended in putting it in motion. Electrical apparatus that is going to give out more than it receives has been a favorite means of deception, and hydraulic appliances have been used successfully for the same purpose. We were invited some time ago to witness tests with an apparatus which carried up pockets full of mercury on a wheel and dropped the loads at a certain point into other pockets, with the idea of utilizing the force of the falling body to produce continuous motion. The men who were interesting themselves in the invention could not see that more energy was expended in raising the mercury than the force produced by its falling by gravity. Like all other inventions of this character, it was not quite perfected, and had not reached the point of working without shoving; but its friends were advancing their money cheerfully, and they are probably still indulging in the pleasures of hope.

What is known in applied mechanics as the law of work is just as certain and inflexible as the law of gravity. The method followed by measuring work is the unit represented by the effort required to raise a weight of one pound one foot. That is called the foot-pound. If you lift a one-pound weight four feet and let it fall, it will strike the ground with an energy of four foot-pounds less a small loss due to the friction of the air it encountered in falling. The men with the mercury apparatus thought that their equivalent of the pound weight must gain greater energy in falling than the amount put into it in the raising process. If you put one thousand foot-pounds of energy into a machine or motor, its efficiency will be measured by the small loss incurred in doing work. With very efficient machines nearly the whole of the energy put in may be utilized, but not quite. There is never any exception to this. Multiplication of levers and wheels merely wastes the power by increase of friction. Those who busy themselves making perpetual-motion machines are trying to cheat nature, and that will never be done.

Power Motors for Shops.

One of the most practical and useful investigations made by the committee of the Master Mechanics' Association last year was on "Motors—Steam, Air and Electric." They appear to have gone very thoroughly into the subject, and seem to have found out every purpose to which various kinds of motors have been applied for the saving of labor. There seems to be scarcely any shop process now but what can be aided and is aided by some kind of power motor.

The conclusion of the committee was that compressed air was preferable to steam or electricity: the principal reason given for this preference was that any ordinary mechanic could repair or find out defects in an air motor, which was not the case in regard to electric motors. Mention was also made that an element of danger exists in connection with electric motors. We had never heard of any accident happening to men handling electric motors used for transmitting power in shops, but there may have been accidents of the kind. We do not suppose that the report of the committee will result in damaging the popularity of electric motors for shop purposes, because nearly all railroad men naturally favor the use of compressed air. They have all been so long accustomed to the air brake, that it seems natural to prefer that kind of power to any other.

Power motors and all kinds of labor saving devices have been written and talked so much about, that there is no fear of intelligent shop managers neglecting to make use of appliances of this kind for every purpose to which they can be applied. The danger is not in making and using these things—it seems to be rather in the opposite direction. Motors, jigs and formers are sometimes used for purposes for which they are not suitable. In visiting a shop lately, we were shown a very well designed jig for doing work that it would not be employed upon once a year. In the making of these kinds of appliances, consideration ought always to be given to how often the operation they are intended to facilitate is to be done in the shop. There are numerous cases where the ordinary tools, in the hands of skilled mechanics, are entirely satisfactory and better. Where this is the case, it is just as well not to expend energy and money on getting out several tools that will be of considerable first cost, and will bring no profit in the end.

Shop foremen, as a rule, are highly practical, sensible men, not likely to be carried away by fads, but now and again it happens that one becomes so enamored of his skill at devising special labor saving appliances, that he rides his hobby away beyond the point of utility. It is all right to put up a lift above a tool where the strength of two men would often be necessary to raise the work, but when the material handled is sufficiently light for one man to lift up comfortably, putting in power hoists is a superfluity. We have often seen overhead travelling cranes employed to carry light articles that a boy could put on his shoulder. Practices of that kind are mere waste of labor. The same tendency runs through the designing of all other kinds of labor saving appliances. Our advice to those who are admirers of such appliances is, Be careful not to let your hobby carry you off your feet.

The Labor of Pushing a Locomotive Through the Air.

One would naturally suppose that the heads of the motive power departments of our leading railroads would know with some accuracy how much of the power of a locomotive was expended in hauling the train, and how much was required to overcome the internal friction, rail friction and wind resistance acting upon the engine itself. From personal experience in noting the small difference there was in the consumption of fuel with a light engine and with a small train, we have long been persuaded that moving the engine alone absorbed a large percentage of the power generated. We were never, however, able to obtain figures showing even an approximation of the power needed to move an engine, although we have repeatedly bothered the heads of mechanical departments by asking for the information.

In view of the scarcity of information on a very important question, we are glad to note that Mr. S. P. Bush, superintendent of motive power of the Pennsylvania lines west of Pittsburg, has recently contributed to the "Railroad Gazette" notes of experiments made to determine the resistance of cars in freight trains, in the course of which the power expended in moving the locomotive was ascertained. The tests were made with consolidation engines pulling trains of about 1,100 tons, at an average speed of 16½ miles an hour. By a previous trial it was found that 30 pounds of coal per mile was required to run the light engines over the divisions at the speed named. It took about 7,000 pounds of coal to take the train over the division. At the rate of 30 pounds per mile the engine used up 3,450 pounds of that quantity of coal, leaving 3,550 for generating the power to haul the train, or 3.23 pounds per ton mile of train.

At first, this might strike railroad men as an excessive amount of coal to be consumed in moving the engine, but reflection will show that the locomotive cuts the hole into the air which enables the cars to follow without much more resistance than that due to journal and rail friction. Anyone who has ridden on a bicycle will appreciate the hard work a locomotive has to do in pushing its wide expanse of front against the air. From these tests, which seem to have been very thorough, it appears that at least one-quarter of the work a locomotive has to do in pulling a train is used up in overcoming the resistance of the atmosphere.

Washing Out Boilers.

We wish to direct the attention of our readers to an article on Boiler Washing, by Mr. Henry J. Raps, foreman boiler maker, of the Burlington, Cedar Rapids & Northern Shops, at Cedar Rapids, Ia. This is the first of a series of articles on The Care, Inspection and Repair of Locomotive Boilers and promises information that will be of the greatest value to every railroad man who is interested in the safety, durability or economical operation of a locomotive boiler. The washing out of boilers is too often regarded as a humble and simple operation which can safely be trusted to the care of an inferior class of laborers who experience no sense of responsibility for the work being properly performed. In many cases the work is carried on under the idea that the quicker the disagreeable job is done the better, and the boiler is little cleaner after the washer is finished than it was when he began. The result of this careless management is that boilers and fireboxes are damaged by scale and mud deposits in a manner that seriously shortens their life, and greatly increases the cost of steam making while the boiler remains in service.

Mr. Raps incidentally directs attention to another defect often encountered by those responsible for keeping boilers clean, which is the placing of wash-out holes in places where they cannot be reached on account of some brace, frame, air pump or other obstruction making them inacessible, Locomotive builders have many sins of this kind to account for. They will place the wash-out holes in the stereotyped places and then cover them up with attachments which need to be removed before washing out can be done properly.

Scale incrusted and mud covered heating surfaces add so much to the cost of maintaining and operating a locomotive boiler, that it might be supposed there would be a strong and healthy sentiment in favor of providing the easiest possible means of washing out properly, but the sentiment is lamentably weak. In the numerous public discussions about the care and safety of locomotive boilers very little has been said about the importance of keeping them clean. If we can rouse this sentiment into active being we shall have performed a valuable service to railroad companies.

Another Gainer from Self-Help.

In connection with the writing of the articles on Care of Boilers, which begins on another page, the author deserves personal mention. Some fifteen years ago Mr. R. W. Bushnell, master mechanic of the Burlington, Cedar Rapids & Northern, organized a night school for the benefit of the men and boys in the shops, at Cedar Rapids, Ia., and several of his foremen, among them the writer, acted as teachers. Henry J. Raps was then a journeyman boiler-maker, with no more education than what he had received years before in a country school. But he had sound ideas about the power of knowledge and was one of the most regular attendants of the class. He studied the lessons carefully and always came to the class well prepared. The school was not prosperous for most of the people soon lost interest, but it gave a beginning to Mr. Raps and he has followed up the studies so well, that he can figure out all the strains to which a boiler is subjected, is well informed on the strength of material, is a fair draughtsman and writes as good English as a college graduate.

Of course when a vacancy for foreman occurred Mr. Raps was promoted to the position. And yet the majority of mechanics think that devoting their spare time to acquiring a knowledge of the principles of their business is lost labor.

A New Theory of Train Resistance.

The echoes of the fast run made on the Lake Shore & Michigan Southern with Dr. Webb's special train eighteen months ago are still ringing in the ears of our British friends. When the particulars of the speed attained were first published in this country, correspondents of British engineering papers raised a storm of protest that the speed claimed was impossible, and they figured out by the long discredited Clark formula that no such speed as reported could possibly be made by the engine which hauled the train. The discussion has been kept up intermittently ever since, and now a new theory has been advanced. A writer in one of the leading engineering papers has advanced the theory that at high speeds the train resistance decreases when certain velocities are reached, and, strange to say, the editor of the paper endorses this view, and uses some diagrams published in "Locomotive Engineering" five years ago to corroborate his opinion. The reason that led to this opinion was that the diagrams of work done at the higher speeds were smaller than those taken when the train was running at a lower velocity.

That is rather logical resoning, but it is based on incomplete premises. When a locomotive has succeeded in lifting a train into its running speed, the work of maintaining that velocity is very light. The labor that puts the greatest stress upon the capacity of a locomotive is that of accelerating the speed. An engine with a good margin of power lifts the train quickly into the running speed, but the mean effective cylinder pressure required to do this is much greater than it is when the running speed is attained. If the load is a little too heavy for the power of a locomotive, it often happens that the steam cut-off does not take place short of half stroke until the running speed is reached. That is why slow speeds often show a larger indicator diagram than the maximum running speed does. Our British friends do not seem, however, to have understood this part of the case.

We publish in another part of the paper an article on "Partially Broken Staybolts," contributed to the Master Mechanics' Convention by Mr. T. A. Lawes, superintendent of motive power of the Chicago & Eastern Illinois. The statements made in the paper deserve the careful consideration of every master mechanic in the country, who is anxious to escape those worst of motive power disasters, boiler explosions. There is no source of danger to a boiler so serious as broken staybolts, and any means pursued to detect that source of weakness ought to be readily taken up by all men in charge of our motive power. It seems to us that Mr. Lawes has successfully proved that the only safeguard for staybolts is either using those that are hollow or staybolts drilled to the point where breakage usually takes place. There have been so many mysterious explosions of locomotive boilers within the last few years when inspection was carefully carried out, that the discoveries made by Mr. Lawes are of the utmost importance, since he has shown that there may be a great many partially broken staybolts in a boiler that the hammer tests and all the other methods of inspection cannot discover.

Don't Touch the Third Rail.

That the third rail electric system has dangers as well as advantages, is shown by the editorials in the leading electrical papers. While it is undoubtedly true that persons have no right to be on the track, the fact remains that they have always used the railway as a foot path and have swelled the coffers of the coroner accordingly. They are not yet educated to appreciate the new danger and as a result numerous accidents are reported, none of them, however, having proved fatal as yet.

One of the mechanical engineers who was making an inspection of the road, touched the third rail with his steel-tipped umbrella and had a little Fourth-of-July celebration all to himself.

As the efficiency of this system seems to be unquestioned, it seems as though some means should be taken to avoid the dangers of decreasing the population of the enterprising Nutmeg State.

BOOK NOTICES.

"The Entropy-Temperature Analysis of Steam-Engine Efficiencies." By Sidney A. Reeve, M. E. Progressive Age Publishing Co., New York. 75 cents.

The author thinks the reason that the entropy method of analyzing heat engine efficiencies has not been received with more favor, is on account of the labor involved in preparing the necessary curves for each case. To obviate this difficulty he has prepared a blank diagram which gives these curves and the book itself explains its use. This will probably be very acceptable to such engineering experts and students as are called upon to make tests of this kind, but it is hardly a book to interest the average engineer.

"Block Signal Operation." A practical Manual by Wm. L. Derr. Van Nostrand & Co., New York. Price $1.50.

This is a book of 270 pages, 4½ x 7 inches, written by a railroad superintendent who tells in very clear language the operating of the block signal system under his charge, and also describes all the leading systems of block signalling. There is a very interesting introductory to the book which gives the history of the origin and development of block signalling. The work is illustrated by various diagrams and half-tone engravings. The book forms an excellent contribution to the subject of railway signals, and deserves to be largely bought by railway men.

The new cosmic force which is going to perform work from nothing under the hands of the great discoverer Keely, whose motor has been under a cloud for the last twenty years, appears to have received new vitality lately through certain railroad men going to examine the working of the motor. We feel sure that the old cycle concerning this motor will again be traversed. The promise of its utility is receiving wide advertising, which will induce more people with money to spare to invest in the so-called discovery, and the promises to put it into some kind of useful service will be kept up until the purses of subscribers are thoroughly drained, when some new pretension will be advanced to secure a fresh supply of dupes.

PERSONAL.

Mr. N. G. Pearsall has resigned as superintendent of the New Orleans division of the Texas & Pacific.

Mr. T. M. Campbell, who has been general manager of the International & Great Northern since 1892, has resigned.

Mr. Wm. C. McMahon has resigned as superintendent of the Springfield division of the Baltimore & Ohio Southwestern.

Mr. J. C. Gregory has resigned as division superintendent of the International & Great Northern, at Palestine, Tex.

Mr. George T. Smith has been appointed eastern superintendent of the Union Line, with headquarters in New York.

Mr. J. M. Ritchie has been appointed purchasing agent of the Pittsburg, Bessemer & Lake Erie, with headquarters at Pittsburg, Pa.

Mr. W. A. M. Lennan has been appointed general purchasing agent of the Mexican Southeastern; headquarters at Cleveland, O.

Mr. Charles C. Culross has been appointed assistant superintendent of the Wyoming division of the Union Pacific, with office at Laramie, Wyo.

Mr. N. E. Matthews has been appointed superintendent of the Ohio Southern, with headquarters at Springfield, O., vice Mr. I. H. Burgoon, resigned.

Mr. Lawrence Noble has been promoted to the position of assistant superintendent of the International & Great Northern, *vice* Mr. Leroy Trice.

Mr. B. G. Plummer has been appointed master mechanic of the Fort Worth & Rio Grande; headquarters at Fort Worth, Texas. He takes the place of Mr. H. D. Galbraith, resigned.

Mr. C. H. Warren has been appointed assistant to the president of the Central of New Jersey, with headquarters in New York. He was formerly general manager of the Great Northern.

Mr. C. L. Williams, superintendent of the Ohio River Railroad at Parkersburg, W. Va., has resigned, and Mr. J. H. Hamilton, of Salt Lake City, Utah, has been appointed to take his place.

Mr. E. S. Brown, general manager of the South Carolina & Georgia at Charleston, S. C., has been promoted to the position of vice-president of that road, with headquarters in New York City.

Mr. W. S. Morris, superintendent of motive power of the Chesapeake & Ohio Railway, covered himself with glory while making it comfortable for the members of both associations at "Old Point."

Mr. J. H. Mathey, of Brussels, Belgium, has been appointed general manager of the Monterey & Mexican Gulf, with headquarters at Monterey, Mex., vice Mr. A. Monnom, resigned.

Mr. W. D. Trump has been appointed general superintendent of the Flint & Pere Marquette, with headquarters at Saginaw, Mich. He has been acting general superintendent for some time.

Mr. George Lawson, chief clerk to the vice-president of the Texas & Pacific, has been appointed assistant general superintendent of the International & Great Northern, with office at Palestine, Texas.

Mr. Joseph H. Sands, who recently resigned as general manager of the Norfolk & Western, has accepted the position of general manager of the South Carolina & Georgia, with headquarters at Charleston, S. C.

Mr. C. Miller, formerly chief engineer of the St. Louis, Chicago & St. Paul, has been appointed superintendent and engineer, to take the place of Mr. W. S. Cooke, resigned. Headquarters at Springfield, Ill.

Mr. A. M. Lane has been promoted to the position of superintendent of the West Virginia & Pittsburgh, with office at Weston, W. Va. He was formerly assistant superintendent, which office has been abolished.

Mr. James W. Andrews, who served an apprenticeship in the Crewe shops of the Norfolk & Western Railway, has been appointed master mechanic of the Norfolk, Albem. & At. R. R., with headquarters at Brambleton, Va.

We will be glad to put any one needing the services of a first class draftsman, well up in locomotive and car work, in correspondence with such a man who has been out of railroad business for three or four years and now desires to return to it.

Mr. L. F. Day has been appointed general manager of the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn. He succeeds Mr. A. L. Mohler, resigned, and was formerly chairman of the Southwestern Traffic Association, of St. Louis.

Mr. Leroy Trice, for the past seven years division superintendent of the eastern division of the Texas & Pacific at Marshall, has been appointed general superintendent of the International & Great Northern, with headquarters at Palestine, Texas.

Mr. J. B. Paul, superintendent of the Rio Grande division of the Texas & Pacific at Big Springs, Tex., has been appointed superintendent of the New Orleans division of that road, with office at New Orleans. Mr. John W. Ward takes the position left vacant by Mr. Paul.

One of the prominent figures at many Master Mechanics' conventions was Mr. W. B. Mack, of Boston, inventor of the famous Mack injector. For some reason

Mr. Mack has been absent for five or six years, but he appeared at Old Point Comfort, and his nand must have suffered from the vigorous shaking it received from old-time friends.

Among the men conspicuously missed at the last Master Mechanics' Convention was Mr. Mord Roberts, master mechanic of the St. Louis, Iron Mountain & Southern. Mr. Roberts has attended only two or three conventions, but he made a very good impression as a ready speaker and as a man with something to say. A number of the members present at the last convention signed a letter expressing regret that Mr. Roberts was absent.

At the thirtieth annual convention of the American Railway Master Mechanics' Association the following officers were elected for next year: Pulaski Leeds, Louisville & Nashville, president; Robert Quayle, Chicago & Northwestern, 1st vice-president; J. H. McConnell, Union Pacific, 2d vice-president; W. S. Morris, Chesapeake & Ohio, 3d vice-president; J. N. Barr, Chicago, Milwaukee & St. Paul, treasurer.

At the annual meeting of the stockholders of the Barre Railroad Company, held in the city of Barre, Vt., May 27, 1897, the following directors were elected: W. A. Stowell, of Montpelier, Vt.; F. W. Stanyan, A. D. Morse, E. L. Smith and John Trow, of Barre, Vt. The following officers were elected by the directors for the ensuing year: A. D. Morse, of Barre, president; W. A. Stowell, of Montpelier, vice-president and managing director; F. W. Stanyan, of Barre, clerk and treasurer.

At the annual meeting of the stockholders of the East Barre & Chelsea Railroad Co., held at East Barre, Vt., June 7, 1897, the following directors were elected: W. M. Carnes, F. L. Sargent, L. I. Cheney and W. C. Nye, of East Barre, Vt., and F. W. Stanyan, of Barre City, Vt. The following officers were elected by the directors for the ensuing year: L. I. Cheney, of East Barre, president; F. L. Sargent, of East Barre, vice-president; F. W. Stanyan, of Barre, clerk and treasurer.

The following official changes have been made on the Norfolk & Western Railway: Mr. C. H. Hix has been appointed trainmaster of the Radford, Pulaski & North Carolina divisions, *vice* Mr. J. M. Bressler, resigned. Mr. R. G. Kenly has been appointed assistant train master Radford division, *vice* Mr. Wm. Brumble, transferred. Mr. F. R. Wadleigh has been appointed road foreman of engines, Radford, Pulaski & North Carolina divisions, *vice* Mr. G. W. Cocke and Mr. D. S. Pile, transferred.

At the thirty-first annual convention of the Master Car Builders' Association, the following officers were re-elected: S. A. Crone, New York Central, president; E. D. Bronner, Michigan Central, 1st vice-president; C. A. Schroyer, Chicago & Northwestern, 2d vice-president; J. T. Chamberlain, Boston & Maine, 3d vice-president; G. W. Demarest, Northern Central, treasurer; G. W. Rhodes, Chicago, Burlington & Quincy; Pulaski Leeds, Louisville & Nashville, and M. M. Martin, Wabash Railroad, members of the Executive Committee.

Since we last went to press, we have news of the death of Mr. John Ramsbottom, one of the celebrated locomotive superintendents of the British Isles. Mr. Ramsbottom was born in 1814, and in 1839 entered the works of Sharp, Roberts & Co., locomotive builders, of Manchester, to learn the business. Three years afterwards he was appointed locomotive superintendent of the Manchester & Birmingham Railway, which afterwards became part of the London & Northwestern, of which he was made locomotive superintendent, and held that position up to 1871. Among the many inventions associated with the name of Mr. Ramsbottom, the water scoop for lifting water from the track to the tender is probably the best known. He also invented a form of safety valve which is used on nearly all locomotives in the British Isles. His piston with three sprung rings is also very well known, and probably has been applied to more locomotives in Europe than any other kind of piston. Since 1871 Mr. Ramsbottom has been a director of the Lancashire & Yorkshire Railway, and acted as consulting engineer for the mechanical department. He also had a connection with the engineering department of Owens College, Manchester, of which he was governor. He was the designer of the famous "Lady of the Lake" class of locomotives, one of which was shown at the World's Fair in Chicago. These engines were the most successful high-speed engines of their day, and some ot them are still running. These engines were designed in 1859, and were as efficient as any modern locomotive.

The new catalog of the Boston Belting Company, 256 Devonshire Street, Boston, is a neat example of modern printing. It shows the different styles of rubber matting made by this firm, as well as car step treads and similar goods.

A certain steamboat line running out of Port Huron, Mich., has a standing rule that clergymen and Indians can travel on its boat for half fare. The other day the agent of the line was approached by an Indian preacher from a Canadian reservation just across the river, who asked for free transportation to his destination on the ground he was entitled to one-half rebate because he was an Indian and the other half because he was a clergyman.

An old Turkish towel is said to be better than cotton waste for cleaning brass work.

The Erie shops at Meadville began running on full time Monday, June 14, with fifty new hands. There has been such improvement in general traffic along the line that the road is now using 500 leased freight cars.

We have received so many compliments about the beauty of the embossed cover that illuminated our June number that it seems right and proper to tell that the work was done by Griffith, Axtell & Cady Co., Holyoke, Mass. Persons likely to have any fancy work of that character done had better take a note of the address.

We have received information that circulars and letters have been sent to railroad men asking them to become students in the Correspondence School of Locomotive Engineering. We wish to say that there is no correspondence school connected with "Locomotive Engineering." The unauthorized use of the name of our paper in connection with a correspondence school is suspicious to say the least of it, and we should advise railroad men to make certain of the parties they are dealing with before sending any money to the so-called "Correspondence School of Locomotive Engineering."

We have received the fourth number of Easy Lessons in Mechanical Drawing and Machine Design, by Mr. J. G. A. Meyer, and published by the Arnold Publishing House, 6 Thomas street, New York. This number is equal in interest and value to any of those that have gone before it, and indicates that the book when finished will be the best manual on mechanical drawing that has ever been published. The price is 50 cents a number, and is worth many times that sum to any young man who is striving to obtain a knowledge of mechanical drawing and machine design.

We have recently seen an article on spray painting with compressed air, which attributed the origin of this process to Mr. T. G. Turner, of New York City, and said that it was first used in painting buildings at the World's Fair in Chicago. This is far from being true. The method of painting by spraying with compressed air originated on the Southern Pacific Railway, and the process was first described in "Locomotive Engineering" seven or eight years ago. It had been in use then for six or seven years. It is wonderful how many inventors of a successful process turn up long after the process has been put into use.

EQUIPMENT NOTES.

The Mexican Government is having two passenger coaches built at Pullman's.

The Jackson & Woodin Co. are to build 200 cars for the Philadelphia & Reading Railway.

One passenger coach is being built at Pullman's for the Des Moines & Kansas City Railway.

An order for 30 locomotives for Japan has been received at the Baldwin Locomotive Works.

The Chicago & Grand Trunk Railway are having 50 cars built by the Michigan & Peninsula Car Co.

The Pittsburg Locomotive Works are building fifteen engines for the Baltimore & Ohio Railway.

The Missouri Car & Foundry Co. are to build 20 60,000-pounds platform cars for the Gulf & Interstate.

The Richmond Locomotive Works are building two engines for the Aberdeen & West End Railway.

The Richmond Locomotive Works are building ten consolidation engines for the Southern Railway.

The Buffalo & Susquehanna Railroad Co. are having one locomotive built by the Dickson Mfg. Co.

The Westmoreland Coal Co. have given an order to the Allison Manufacturing Co. for 100 cars.

The Missouri Car & Foundry Co. are building 29 refrigerator cars for the St. Louis Refrigerator Car Co.

The Atchison, Topeka & Santa Fe are having six ten-wheelers built at the Dickson Locomotive Works.

The Baldwin Locomotive Works are building six six-wheel connected engines for the Texas Pacific Railway.

The Great Northern are to have 15 moguls with 19 x 26-inch cylinders built at the Brooks Locomotive Works.

The Chicago, St. Paul, Minn. & Omaha Railway have ordered 50 freight cars from the Haskell & Barker Car Company.

The St. Lawrence & Adirondack have placed an order for 3 eight-wheel engines with the Brooks Locomotive Works.

The Michigan Car & Foundry Co. are to build 50 box cars and 2 cabooses for the Mexico, Cuernavaca & Pacific Ry.

The Buffalo Car Manufacturing Co., of Buffalo, N. Y., are to build 200 freight cars for the Buffalo, Rochester & Pittsburg.

The Baldwin Locomotive Works are building one eight-wheel connected engine for the Oahu Railway & Land Company.

A number of state room sleeping cars have been built by the Canadian Pacific for the demands of their English tourist traffic.

The New Orleans & Northeastern Railway are having one eight-wheeler built at the Richmond Locomotive Works.

The Mobile & Ohio Railway are having 400 freight cars built at Pullman's, and have placed an order for ten passenger cars with the Barney & Smith Company.

Among the orders recently received by the Schenectady Locomotive Works are eight ten-wheel compound freight locomotives, having cylinders 22 inches and 34 x 26 inches, for the Northern Pacific Railway. These engines are duplicate of two of the same class built for the Northern Pacific by the Schenectady Works, last March. Five ten-wheel freight engines, cylinders 18 x 24 inches, for the Florida East Coast Line; two eight-wheel passenger engines, cylinders 18 x 24 inches, for the Detroit, Grand Rapids & Western and two six-wheel switching locomotives, cylinders 19 x 24 inches, for the Houston & Texas Central.

The Schenectady Locomotive Works have received an order for 12 narrow gage passenger locomotives for the Kiushiu Railway Co. of Japan. The general design is of the American type, with cylinders 16-inch diameter and 24-inch stroke, and the driving wheels are 56 inches diameter. The tenders have six wheels, the general design being similar to that used on the railroads of England. The locomotives are to be built to run on 3 feet 6 inch track, that being the standard gage of the railroads of Japan. On completion, each locomotive will be tested under steam on a temporary track at the works, and after inspection will be taken apart and packed for loading on steamship at New York.

A New Mountain Railway.

A start has been made on the railroad to run from Scheidegg, which is over 6,800 feet above sea level, to a point on the plateau only 217 feet below the summit of the Jungfrau, a rise of 6,800 feet from the starting point. From the railroad terminus to the summit there will be elevators, on the American style probably. The present plans are that this elevator should consist of two concentric iron cylinders, placed telescope fashion one within the other. The inner one will contain the lift, and between the two a spiral staircase will be fitted, so that tourists may choose between using the lift and climbing the distance from the railway terminus to the summit on foot.

The construction, rack railway, etc., will be similar to that of the Wengern Alp line. The total length of the railway will be 12,443 meters, and it will be divided into six sections, with intermediate stopping places and stations to be known as Eiger Glacier, Grindelwald View, Kalifirn (Eiger Station) Mönchjoch, Aletsch Guggi (Jungfraujoch), and Jungfrau (terminus). The maximum gradient will be one in four and the minimum one in ten, quite an easy climb compared, say, with Pilatus. The journey is calculated to occupy exactly 100 minutes.

Some of the conditions imposed are: That it shall be completed within five years. That the railway company is bound at all times to permit persons making the ascent of the Jungfrau on foot to have access to all parts of the mountain free of charge and without any restrictions whatsoever. Articles of scientific or historic interest brought to light in the course of the excavations become the property of the canton in whose territory they are found. On the completion of the whole or a part of the line the company are required to expend a sum of at least 100,000 francs in erecting and equipping a perfect observatory on the summit for the purpose of assisting meteorological, tellural and other forms of physical research; and in addition they bind themselves to contribute a monthly subscription of 1,000 francs towards the expenses of the undertaking. This, in conjunction with a series of meteorological stations at different altitudes along the line, will give Switzerland an observatory of the very first rank. Finally, the government reserve to themselves the right to buy out the company after the lapse of a certain number of years, and to take over the working of the concern themselves. It is proposed to use electricity generated from the Trummelboch and the Black and White Lutschiner.

One of the greatest attractions to the motive power men at the convention, and an object lesson of interest to every visitor, was the exhibit of the Richmond Locomotive Works, placed in front of the "Chamberlin." It consisted of a smoke arch with the steam pipes, receiver, and exhaust pipe; the whole mounted on a pair of cylinders 19 x 30 x 24 inches stroke. The intercepting valve chamber being cut at an angle of 90 degrees so as to show the operation of the valve which was fitted with a handle so as to make plain its functions while working simple or compound. The whole thing reflected credit on the foresight and originality of the Richmond people.

A curious strike took place in the Lake Shore shops at Buffalo last month. An order was issued requiring the men to wash before leaving the shops, and a lot of men struck before they would comply with the order.

As Others See Us.

"The province of this supplement is to call attention to progress made in decorative art, which art may cover many subjects. The June number of 'Locomotive Engineering' — the cover — appears in brilliant red and yellow, outlined with black, the effects of which are excellent. Advantage has been taken of the embossing process. Design and lettering are capital. In fact, this cover is the best we have seen, and credit should be given to the artist and printer."—"New York Times."

"'Locomotive Engineering,' the very handsome magazine issued in the interests of railway motive power and rolling stock, makes some changes in its editorial management with the June number. The publication is technical in character, of course, and does much to instruct the men in the mechanical departments of railroads, and by putting information in an attractive form helps to make them greater readers and closer students of the intricacies of their callling. It is publisted in New York city."—"Indianapolis Journal."

"'Locomotive Engineering'—The June number of this splendid publication is expensively illustrated and very handsome, and must be of great interest to all railroad men and to artisans in general. It is full of good things relating to locomotive engineering and locomotive construction. One illustration shows an engine which exploded on a Norway railroad, was tossed up into the air, and landed upside down on another engine, which afterward carried it to the shops twenty miles away. Charts and illustrations, numerous and elegant, give a graphic history of the development of the modern locomotive, and other pictures show machines used in car shops and engine works, motive power and rolling stock. With the June issue Mr. John A. Hill, its first editor (formerly of Pueblo), severs his connection with the 'Locomotive Engineering' to become president and treasurer of the 'American Machinist.' This change leaves Mr. Angus Sinclair sole proprietor of the paper, and for business convenience it has been incorporated into a joint stock company, called the 'Angus Sinclair Company,' located at 256 Broadway, New York. Mr. Hill, however, will still contribute to 'Locomotive Engineering.' The price is $2 per year; single copies 20 cents."—"Daily Chieftain," Pueblo, Col.

"'Locomotive Engineering' for June is a handsome number, full of matter of interest to engineers and locomotive builders, whoever, in fact, has to do with railroad rolling stock or motive power. It is copiously illustrated. (New York: 'Locomotive Engineering,' 256 Broadway.)"—"Detroit Free Press."

"'Locomotive Engineering,' June, is an elegant number, and contains most valuable material for railroad men of all grades. A long list of personals about prominent railroad men adds to its completeness. New York."—Omaha "World-Herald."

"The June number of 'Locomotive Engineering' comes in a brilliant red cover with embossing in golden yellow. It is a practical journal of railway motive power and rolling stock, and its contents relate to railroads and railroading. The illustrations are mainly fine photographic engravings. Published by the Angus Sinclair Company, New York."—"Evening Wisconsin."

The Biograph.

A sort of favorite exhibition in the places of amusement of our largest cities for the last few months has been the biograph, which is a series of photographs showing moving objects, the same as they appear in motion. Troops marching, horses racing, and a great many exciting subjects are favorite matters of display, but that which appears to attract the greatest attention is the express trains running at high speed.

In New York City, the Empire State Express coming along through the canvas as if it were the real train, has excited the audience to such an extent that ladies have frequently fainted, expecting that they were going to be run down by the locomotive.

This show has recently been carried to England, the Empire State Express being the principal attraction. Our British friends have always been skeptical about American express trains running at the high rate represented by railroad and engineering papers, but they seem now to have got evidence that the trains really do run at the speeds reported. It is not an exaggeration to say that nothing in the way of a spectacle has ever captured the British hearts so completely as this ingenious idea of an American inventor.

New Railroad Shops.

Atlanta, Knoxville & Northern Railway have recently built new shops at Blue Ridge, Ga. The arrangements of the shop buildings are complete and convenient; they are equipped with the latest improved machine tools for locomotive and car work, and were furnished by the Niles Tool Company. The tools are of the latest pattern and are complete in every particular. The placing of the tools is in as systematic a manner as possible to facilitate rapid work. Great credit is due to the able management of Mr. Jos. McWilliams, general manager, in the energy shown in having the shops completed in so short a time.

Mr. T. W. Newell, is master mechanic in charge of locomotive and car department, and is deserving of mention for the manner in which he has arranged the machinery for economical results.

Age of the Clamp Fastening for Cylinders.

In our June issue we illustrated the Southern Pacific method of securing cylinders to the frames by the use of double lugs on the bottom of the cylinder, the lugs fitting the frame on the top and two sides, and the clamp passing under the frame and over four studs.

This style of fastening seems to be now in its renascent stage, for it transpires that the same idea was evolved by Mr. Thatcher Perkins on the Louisville & Nashville Railroad about the year 1873, and has been the accepted standard of the road since that date. While no claim for originality was made for the method as shown by our engraving, the inference that the road in question might justly claim precedence over others in the use of the device would be a natural one, therefore the facts as above, for which we are indebted to Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville Railroad. It is a good thing, no matter who its sponsorship can be traced to.

There is something curious about the working of the Hardie air motor on 125th Street, New York. The cylinders are 7 x 14 inches, the wheel is 26 inches diameter, and the capacity of both cylinders swept through by piston in one mile, including clearance, is 992 cubic feet. The motor used 400 cubic feet of free air. This has appeared a paradox to a great many engineers, for the general impression is that an engine using compressed air as a driving medium must pass through the cylinders a volume of free air much in excess of the capacity of the cylinders. The reheating of the air used in the Hardie motors accounts for the small volume used.

When we published the handsome pictures in our June issue, of the New York Central's new Harlem bridge we omitted to mention that the engravings were made from photographs taken by that king of amateurs, Mr. F. W. Blauvelt.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The M. C. B. Discussion on Dummy Couplings.

One of the noon hour topical discussions at the Old Point Comfort convention of the Master Car Builders was, "Is the retention of the dummy couplers on freight equipment desirable?"

Mr. Brazier spoke from notes as follows:

"The present dummy coupling is not a success, no matter where located. If located as formerly it ruins the hose by kinking same, if located under the drawbar it is unhandy to get at and trainmen will slight its use when cutting and switching a train on account of the position they have to get into, to accomplish the work necessary, and on account of the time required.

"The coupling is defective inasmuch as it permits of the hose being hung upon it, in other than the proper way to cover its opening; that is, hose can be hooked to the dummy in such a way that the opening will not be covered at all, and in this position hose will naturally collect more dirt than if it were allowed to hang loose.

"There is no doubt in my mind as to the necessity for some means of protecting the air equipment when hose is uncoupled to keep dust and cinders from reaching the triple valve, and to prevent snow and sleet from blowing into hose and freezing.

"I think a new form of coupling is needed, or the hose couplings should be provided with an automatic arrangement for closing the openings when uncoupled and then the hose could be allowed to hang. The latter arrangement would probably be the best, as it would obviate the necessity of relying on a peculiar class of trainmen to obey instructions.

"Would like to hear from those who have had experience in letting hose hang loose as to whether it has been found detrimental to the hose on account of its striking ballast or crossings."

Mr. Rhodes (being called on): "We abandoned the use of dummy couplings because they were applied in a bad manner. It produced a kink in the hose. When we abandoned its use we took the precaution of never allowing the hose to get less than four inches from the top of the rail, and our experience has been satisfactory without the use of the dummy. If there was some method by which the opening of the hose could be covered when it is closed it is better than having it left open."

Mr. Schroyer: "We took off the dummy couplings on the C. & N. W. but have not been satisfied by any means. Scarcely a week goes by but what we have letters from the men complaining of the difficulty they have in consequence of dust in the strainers and valves. This is due to the vacuum created by the car in its motion, especially from the dust from cinders in the switching yard. Our practice is to hang our hose six inches above the top of the rail. I am of the opinion that some device put on the hose to close it when uncoupled would be excellent. I have never seen anything better than the original check-valve device used for that purpose by the Westinghouse Company, and which has been abandoned, I presume, on account of its obstructing the air passage. We have had several devices in the way of clamps, but they freeze tight to the gasket in the winter, and in opening them pieces of the gasket are torn off. This produces a leak and it is impracticable to use them."

Mr. Higgins: "Our road has not as yet abandoned the dummy coupling. We think the dummy is better than nothing, and furthermore we do not find, with the location we have, any serious trouble with the kinking of the hose. Mr. Brazier spoke about the hose being hooked up improperly on the dummy coupling. With the latest type that is impossible; they have either got to hang it up properly or not at all."

Report of the M. C. B. Committee on Brake Shoes.

Mr. S. P. Bush, chairman of the committee on Brake Shoe Tests, reported at the Old Point Comfort convention as follows:

"The committee has no report to make. I might explain this by saying that the previous investigations and laboratory tests seemed to cover the ground pretty well, and that since the presentation of the last report there does not seem to have been a sufficient development of the question in a sufficiently large number of brake-shoe metals or compositions to justify tests on such a large scale just at this time. No doubt the development going on will make a test necessary a year or two hence."

Report of the M. C. B. Committee on Triple Valves.

Mr. G. W. Rhodes, chairman of the committee on Triple Valve Tests, reported at the Old Point Comfort convention as follows:

"The committee on triple valves would report that no triple valves have been submitted to them for tests during the past year. We would also remind the members of this association and the railway managers that the association has done a great deal of important and expensive work in investigations pertaining to the triples, and we think it advisable that the managers of railroads should know that the triples they apply to their cars conform to the standards of the association."

Air-Brake Items.

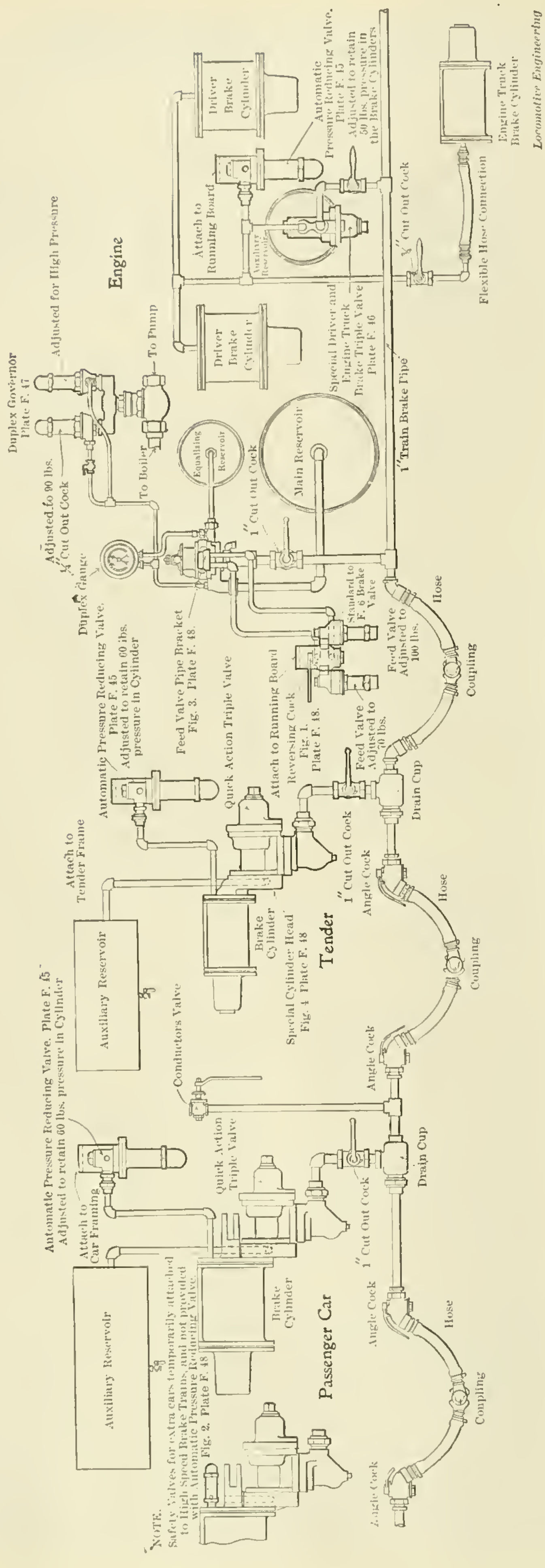
The high-speed brake has been in service on the Empire State Express trains for three years past. During this time not a single case of slid flat wheels has been reported from cars in these trains—an exceptionally good record.

From 1886 to 1896 the distance required in which to bring a passenger train to a stop from a speed of 60 miles per hour has been reduced almost one-half. This is the record of the high-speed brake compared to that of the plain automatic form.

The high-speed brake will stop passenger trains in emergencies in about 30 per cent. less distance than is required with the best brakes heretofore used. The brake apparatus is the standard Westinghouse-quick-action with a pressure-regulating attachment. The addition of pressure-regulating devices to the existing quick-action brake fixtures for both locomotives and cars is all that is required to convert them into high-speed brakes. The superior stopping capacity is obtained by increasing the standard air pressure of 70 pounds to about 110 pounds.

The distance in which a train can be stopped from a speed of 40 miles per hour is nearly twice as great as that from which it can be stopped from a speed of 30 miles per hour. At 50 miles per hour, the stopping distance is more than three times as great as that required at 40 miles per hour. At 60 miles per hour, the distance required for stopping is about five times as great as that required for 30 miles per hour, and more than two and one-half times as great as that required at 40 miles per hour.

The Burlington route between Chicago, St. Paul and Minneapolis, lays claim to "the finest train in the world" in a neat booklet by that title. The engravings are very fine, and the views, both interior and exterior, lead one to believe their claim is not without foundation. Their bill-of-fare, which occupies the page opposite the dining-car interior, is tempting enough to lead to a selection of this route by those who like to satisfy the inner man.



WESTINGHOUSE HIGH-SPEED BRAKE.

The Westinghouse High-Speed Brake.

The high speed brake has been designed to meet the exceptional requirements of regular trains which are scheduled to run at much higher average rates of speed than have heretofore prevailed in passenger train service. No arguments, or even statements of fact, concerning the special conditions attending such unusually speeded trains will be necessary to make it clear to those operating them that the most efficient means of promptly reducing speed is of the greatest importance, if it can be secured by employing simple and reliable appliances. The term "reliable" is used in the most literal and extreme sense of its application to mechanics, as the brake service upon such trains requires that the brake apparatus shall be characterized by this quality above all others.

The high speed brake will stop passenger trains in emergencies in about 30 per cent. less distance than is required with the best brakes heretofore used.

The brake apparatus is the standard Westinghouse Quick Action with a pressure regulating attachment.

The addition of pressure-regulating devices to the existing quick action brake fixtures for both locomotives and cars is all that is required to convert them into high speed brakes.

The superior stopping capacity is obtained by increasing the standard air pressure of 70 pounds to about 110 pounds.

OPERATING CONDITIONS OF HIGH-SPEED TRAINS.

In order to appreciate the various advantages of this improved brake apparatus upon trains running at high average rates of speed, it is necessary to keep in view the special circumstances under which such trains are operated. While many local and ordinary express trains frequently run at very high speeds in convenient places and for short distances, this is done under conditions that involve no unusual risks. The chief characteristic of the special train service here considered is not so much the maximum speed attained as its high average rate between terminals, which requires a velocity through yards and over bridges, switches and crossings (where ordinary trains are required to be under full control) not heretofore demanded and consequently not provided for.

Signals have generally been located at distances from the danger points that will give ample space in which to bring trains to a stop from customary speeds; but they must still be sufficiently near to avoid interference with the orderly movement of trains by unnecessarily retarding their progress at remote distances. The distance between block signals, on roads subject to heavy traffic, has been likewise established upon these principles. The introduction of a train service in which the speed is considerably greater than that for which the operating conditions of the road have been established, is accompanied by complications of greater gravity than would readily be anticipated. The distance in which a train can be stopped from a speed of forty miles per hour is nearly twice as great as that from which it can be stopped from a speed of thirty miles per hour. At fifty miles per hour, the stopping distance is more than three times as great as that required at thirty miles per hour, and nearly twice as great as that required at forty miles per hour. At sixty miles per hour, the distance required for stopping is about five times as great as that required for thirty miles per hour, and more than two and one-half times as great as that required at forty miles per hour. In addition, the frequency of meeting danger signals—and therefore the frequency with which applications of the brakes are likely to occur—increases directly with the speed. It is therefore important that unusually frequent applications of the brake shall be provided for, without seriously impairing the ability at any instant to promptly and effectively respond to an emergency.

The objections to materially increasing the distance between signals and the points which they protect, or introducing additional signals for the special protection of such fast trains, are many and obvious, and a ready solution of the problem seems to be found only in providing high speed trains with a brake apparatus of extraordinary efficiency to meet the requirements of the special conditions, and in a manner that will enable such trains to be operated with the same degree of safety as is now common with ordinary express trains, in so far as the controlling of speed by power brakes is concerned.

This we are now prepared to do.

PROGRESS OF THE AIR-BRAKE ART.

The invention of the quick action air brake in 1886, marked a great forward step in railroad train braking. Merely by the more expeditious realization of the full pressure of the brake shoes upon the wheels of each car, and by the more expeditious serial application of the brakes —that is, successive application of the brakes upon car after car throughout the train—long freight trains were stopped by the quick acting brake in about 50 per cent. less distance than that required by the old automatic brake. Passenger trains, consisting as they do of a much smaller number of vehicles, were not benefited to the same extent as freight trains, by the reduced time of serial application of the brakes; but still, when employing the same ultimate pressure of the brake shoes upon the wheels, passenger train stops were also shortened about 20 per cent. by the use of the quick acting brake. Added to this increased stopping efficiency in emergencies, the quick action brake solved a most important practical requirement in railroad train braking. It, in effect, incorporates, in one structure, two distinct brake systems; one, to be used for all the ordinary requirements of train scrivce, employs such a gradual and limited power of application that the operations of the brake are characterized by moderation, and the liability of sliding wheels is reduced to a practical minimum; the other, to be used under exceptional conditions, when the emergency requires the most prompt and quick stop, is practically instantaneous, and 20 per cent. more powerful in its application. That this double result, of such great importance, should have been accomplished by a slight addition of mechanism to that of the automatic brake, was a most fortunate circumstance; for, while the advantage of such a double system of brakes was and is clear, upon the mere announcement, the thoroughly demonstrated reliability of the old automatic brake was still retained intact, so that a demonstration, through long experience, of the important element of reliability, was not necessary to inspire full confidence in the quick action brake.

The value of the improved apparatus was therefore such as to lead almost immediately to its adoption in the passenger service of the principal railroads of this country. In operation, it promptly developed the fact that the brake gear—levers, rods, brake beams, etc.—which had theretofore been used, was not sufficiently strong to withstand the sudden strains to which it was subjected in emergency applications of the quick action brake. Prior to that time, there had been no standard practice in proportioning brake gear, but under the new conditions it became the subject of investigation by the Master Car Builders' Association, which resulted in formulated standards of sizes for the various parts of the brake gear, abundantly strong for the service to which it is subjected by the quick action brake. These standards have been generally adopted, and it is probable that, with such efficient accessories, the quick action brake reaches the highest practical efficiency in train stopping that can be obtained with a uniform pressure of the brake shoes upon the wheels, that pressure being so limited as to avoid wheel sliding in a serious degree.

MORE EXACTING CONDITIONS HAVE ARISEN.

Under the conditions which have hitherto prevailed, it would therefore seem that the quick action brake has fully met the requirements of the times. The more recent practice, however, of regularly running such trains as are now operated between New York and Buffalo, and New York and Washington, undoubtedly introduces more exacting demands for the prompt control of speed by the air brakes, if a higher efficiency can be obtained with equal reliability. So far as is now known, there is but one method of increasing the efficiency of the quick action brake; and, realizing the importance of the new demands, advantage has been taken of this single avenue in securing the increased efficiency of the High Speed Brake, to the merits of which attention is now called.

THE PRINCIPLE UTILIZED BY THE HIGH-SPEED BRAKE.

The Westinghouse-Galton experiments, carried on in England in 1878, first demonstrated that, while the adhesion between the wheel and the rail—which causes the wheels to persist in their rotation—is practically uniform at different speeds, the friction between the brake shoe and the wheel—which resists the rotation of the wheel, and thereby stops the train—is considerably less when the wheels are revolving rapidly than when they revolve slowly. It was thereby demonstrated that a greater pressure could not only be safely applied to the wheels by the brake shoes, at high speeds, but also that such considerably greater brake shoe pressure must be applied to the wheels at high speeds, in order to resist the motion of the train as effectually as with the more moderate brake shoe pressure at low speeds. More recent investigation by the Master Car Builders' Association in this country, have fully confirmed the results demonstrated in the Westinghouse-Galton experiments.

During the progress of the experiments in England, special mechanisms, of a somewhat delicate character, were employed with the old automatic brake to regulate a variable pressure of the brake shoes upon the wheels—beginning with a considerable pressure at high speeds and reducing to a moderate pressure when the speed became much reduced—whereby much shorter train stops were secured than had ever been attained in any other way. No practical application of this apparatus was made in regular service, however, chiefly for two reasons: One was that the conditions of regular train service did not appear at that time such as to necessitate the utilization of this principle; the other was that, as already indicated, the regular appliances there used were of a somewhat delicate and complicated nature, which appeared to be inconsistent with that exacting element of complete reliability which must characterize an air brake apparatus.

With the invention of the quick action brake, however, the presence of the emergency brake, in addition to the ordinary automatic brake for service use, prepared the way to an entirely practical application of the principle so long ago discovered, by means of simple and reliable mechanisms. Fortunately too, the improved brake gear, realized in the modern standards of the Master Car Builders' Association, is found to be adequate for such an increased duty as is imposed upon it in producing the increased brake shoe pressures which are utilized at high speeds by the High Speed Brake.

THE HIGH-SPEED BRAKE APPARATUS.

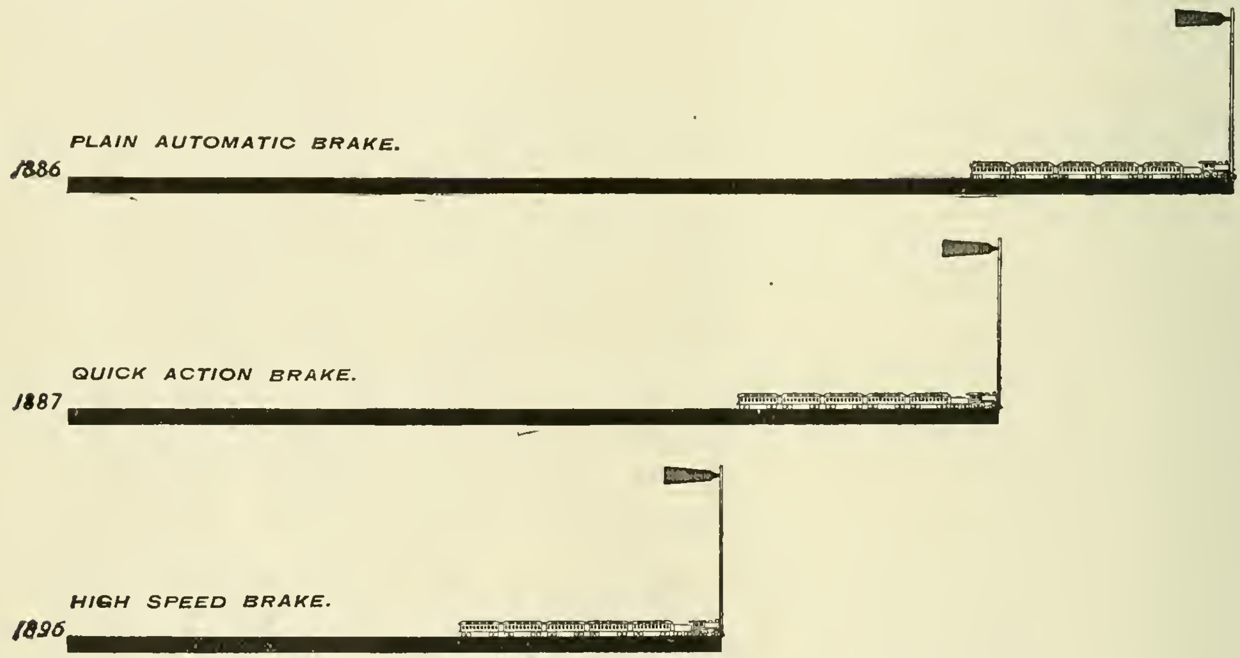
The apparatus of the high speed brake is very simple. It consists of the quick action air brake apparatus, as ordinarily applied to a passenger car—and which is so familiar as to need no further explanation—to which is added an automatic reducing valve that is adapted to be secured quite readily to the car sills or to any point in the vicinity of the brake cylinder, to which it is connected by means of suitable piping. It is therefore only necessary to add this pressure reducing valve to the quick action brake apparatus, already in use upon any passenger car provided with standard brake gear, to convert the apparatus into the high speed brake. This automatic pressure reducing valve is so constructed that it remains inert in all service applications of the brake, unless, at any time, the brake cylinder pressure becomes greater than 60 pounds per square inch (for which the pressure reducing valve is ordinarily adjusted), in which case the reducing valve operates to promptly discharge from the brake cylinder so much air as is necessary to restrict the cylinder pressure to 60 pounds. It will thus at once be apparent that the maximum brake cylinder pressure, in all service applications of the brakes, is restricted to 60 pounds, regardless of the air pressure normally carried in the train pipe and auxiliary reservoirs. In an emergency application of the brakes the violent admission of a large volume of air to the brake cylinder (only made possible by the quick action feature of locally venting the train pipe) raises the pressure more rapidly than it can be discharged through the capacious service port of the reducing valve, and the port thereby becomes partially closed, restricting the discharge of air from the brake cylinder in such a manner that the pressure in the brake cylinder does not become reduced to 60 pounds until the speed of the train has been very materially decreased.

In order to cause this High Speed Brake apparatus to beome practically effective for producing the increased stopping efficiency, the pressure of the air carried in the train pipe and auxiliary reservoirs is increased from 70 pounds (the customary standard) to about 110 pounds per square inch. With this pressure in the train pipe and auxiliary reservoirs, an emergency application of the brakes almost instantly fills the brake cylinders with air at nearly 85 pounds pressure, thereby increasing the braking force from about 90 per cent. (the customary standard) to about 125 per cent. of the weight of the car. Or, in other words, the pressure of the brake shoes upon the wheels is about 40 per cent. greater, at this instant, than is realized by the mere use of the quick action brake. The air pressure immediately begins to escape from each brake cylinder, through the automatic reducing valve, and continues to do so until the brake cylinder pressure becomes 60 pounds, which is thereafter retained until the brakes are released by the engineer.

On account of the high pressure normally carried in the auxiliary reservoirs (110 pounds), a full service application of the brakes (charging the brake cylinders with air at 60 pounds) may be made, and still leave the pressure in the auxiliary reservoirs at nearly 100 pounds. If, after releasing the brakes, a second application of the brakes should be called for before there has been time to recharge the reservoirs, there is abundant air yet stored in the reservoirs to make a second, and even a third, full service application, and still leave sufficient air pressure to make an emergency stop equal to that of the ordinary quick action brake. These advantages, coupled with such a restricted brake cylinder pressure for all service applications of the brake, that wheel sliding is entirely avoided, require no further comment to insure recognition of their importance upon trains of unusually high speed. By simple additions to the brake apparatus on the locomotive, the train pipe pressure is easily and quickly changed to 70 pounds, when the locomotive is used in other kinds of service, and vice versa.

IMPORTANCE OF THE LOCOMOTIVE TRUCK BRAKE.

As a first consideration, high stopping efficiency of the brakes demands that every wheel of the entire train shall be fitted with a brake shoe. The practice, in times past, of applying brake shoes to only four of the wheels of six-wheel trucks, has been almost universally abandoned upon conviction of the fact that such a practice impairs the efficiency of the brakes by 33 per cent. The importance of efficient brakes upon the locomotive driving wheels is also fully recognized. In addition, however, experience with the use of brakes upon the leading locomotive truck has demonstrated the entire practicability of applying brakes to the wheels of the engine truck, and it may be unhesitatingly stated that proper security for high speed trains requires the application of brakes to every wheel in the train. Trains scheduled to run at exceptionally high speeds are necessarily limited in respect to their weight and length,



GRAPHIC ILLUSTRATION OF TRAIN STOPPING, SHOWING THE ADVANCEMENT IN THE AIR-BRAKE ART FROM 1886 TO 1896.

while powerful locomotives are required to haul them. It thus occurs that the weight carried to the rails by the leading truck of a locomotive is about one-twelfth that of the whole train. Neglect to provide brakes for the locomotive truck upon such trains, robs the stopping efficiency of the brakes by nearly 10 per cent. It seems manifestly inconsistent to neglect such an important factor in high brake efficiency, and the use of the locomotive truck brake is therefore considered an essential in every case where the superior stopping efficiency of the High Speed Brake is desirable.

RECORD OF THE PRACTICAL OPERATION OF THE HIGH-SPEED BRAKE.

The high speed brake apparatus was introduced into practical service upon the "Empire State Express" trains of the New York Central & Hudson River Railroad three years ago, and has continued in most satisfactory service since that time. We understand that during all that time, while the brake apparatus has rendered exceptionally efficient service, not a single case of slid flat wheels has been reported from the cars of those trains.

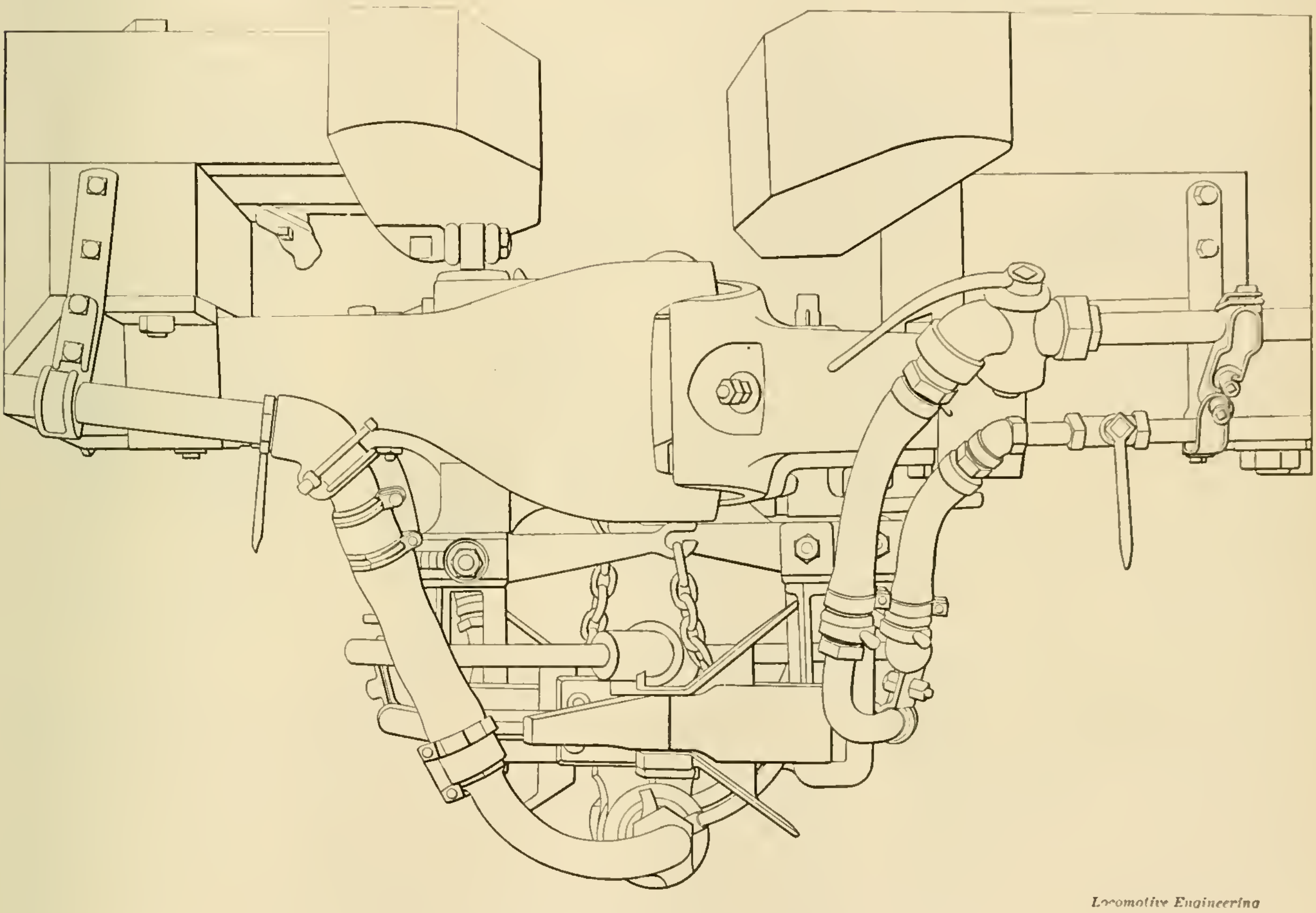
Early in October, 1894, a system of experiments with the high speed brake, in comparison with the ordinary quick action brake, was made upon a passenger train of six cars upon the Pennsylvania Railroad. These experiments were made upon a falling grade of about 30 feet to the mile, and uniformly demonstrated that, at a speed of 60 miles per hour, the emergency stops with the high speed brake are more than 450 feet shorter than with the ordinary quick action brake. Since that time the "Congressional Limited" trains of the Pennsylvania Railroad, running between New York and Washington, have been equipped with the high speed brake apparatus, which has operated in a most efficient and highly satisfactory manner.

The record of the high speed brake upon the fast rains of the New York Central and Pennsylvania Railroads has not only demonstrated the superior efficiency of this brake apparatus, but also fully justifies our confidence in the thoroughly practical and reliable character of the apparatus.

The progress in train stopping during a period of ten years, in which such strides have been made in the speed of passenger transportation, is interestingly illustrated by the following diagram, drawn to scale, representing the stops made with the different types of air brakes:

Fig. 1 shows a vertical cross section and Fig. 2 a horizontal cross section through the slide valve of the reducing valve, which in practice, is attached to some convenient point on the car or engine, by its bracket *X*, and is connected to the brake cylinder by piping thereto from union swivel 15, Fig. 5, at *Z*. It will be manifest that chamber *d* is at all times in communication with the brake cylinder and that piston 4 will be subject to whatever pressure may be therein, while an adjusting spring, 11, on its opposite side, provides resistance to its movement downward, which is limited to chamber *c*, or until it strikes the upper surface of spring case 3. This resistance can be readily varied by adjusting nut 12 as may be required. Combined with piston 4 is its stem 6, fitted with two collars, between which slide valve 8 is carried and moved coincident with the movement of piston 4 when subjected to air pressure from the brake cylinder and such pressure is in excess of the resistance of spring 11. Slide valve 8 is represented by cross-hatched lines in Figs. 3, 4 and 5, and is fitted with a triangular shaped port, *b*, in its face, which is always in communication with chamber *d*, while a rectangular form of port, *a*, is arranged in its seat and is always in communication with the outside atmosphere at exhaust opening *Y*.

In Figs. 1 and 3 the slide valve 8, and its piston, 4, are shown in the normal position occupied so long as the pressure in the brake cylinder does not exceed 60 pounds per square inch, when used with passenger car brakes, or 50 pounds when



AUTOMATIC AIR AND STEAM COUPLING DEVICE, ST. LOUIS, MO.

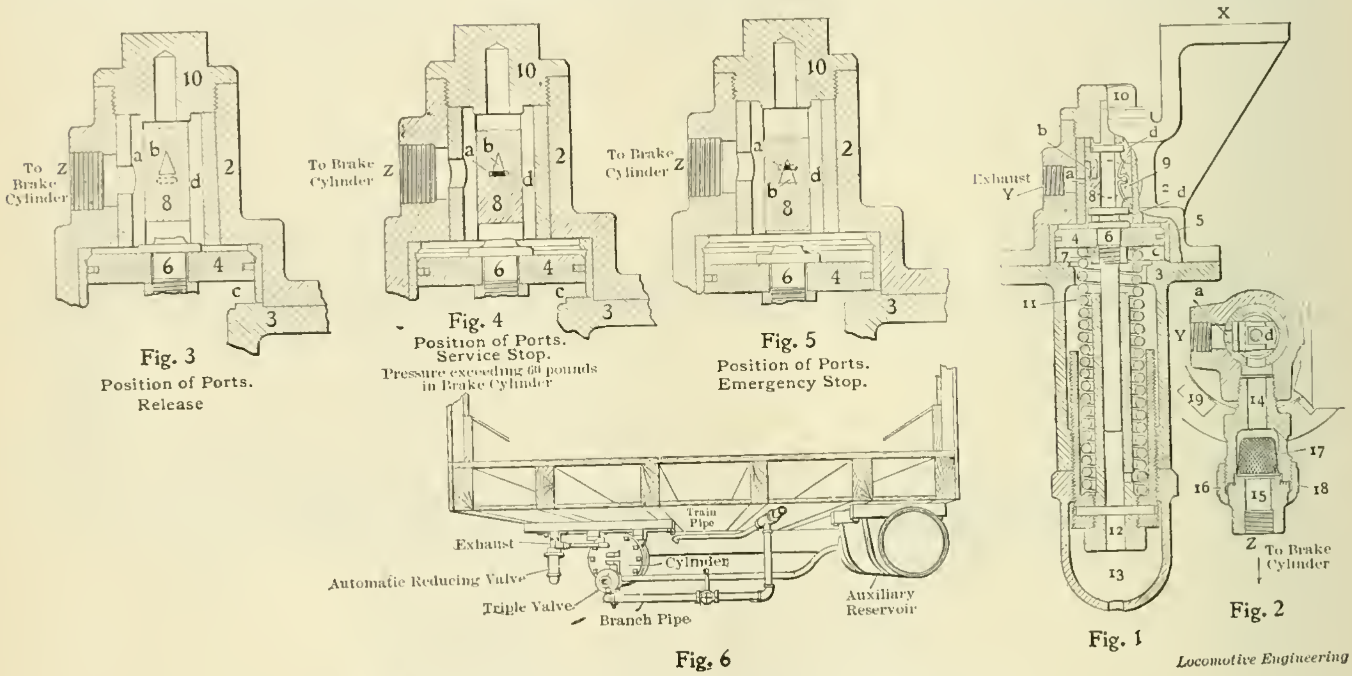
(Exhibited at Old Point Comfort, M. C. B. and M. M. Conventions.)

used with driver brakes, suitable adjustment for either pressure being made by compressing or releasing the tension on spring 11. It will be noted that port *b* in the slide valve 8 and port *a* in its seat in this position are not in register and the pressure is therefore retained in the cylinder until the release of the brakes is effected in the usual manner.

When the pressure in the brake cylinder exceeds 60 pounds, with an ordinary service aplication of the brakes the pressure acting on piston 4 moves it downward slightly until port *b* in the slide valve and port *a* in its seat are brought into register, as in Fig. 4, enabling the surplus air to be vented to the atmosphere, when spring 11 forces the piston and slide valve to their normal position as train, until finally closing, the desired pressure is retained in the brake cylinder until released in the ordinary manner. In performing this function air pressure in a large volume is discharged into the brake cylinder from both the auxiliary reservoir and train pipe, through openings largely in excess of the area of ports *a* and *b*, which latter are consequently unable to discharge it to the atmosphere with equal rapidity, enabling piston 4 to be quickly driven throughout its entire possible traverse and the apex of port *b* is presented to port *a*, giving an area through which the excess air is slowly discharged to the atmosphere, but gradually increasing in a required degree as the piston and slide valve ascend to their normally closed position.

the brake cylinder, on account of the formation of its seat, on which particles of foreign matter may lodge and cause it to leak all of the pressure out of the cylinder; but such matter will be shoved out of the way by the slide valve construction of the automatic reducing valve, to which is added the advantage of lap in sealing the outlet or exhaust passage.

In issuing a recent catalog we inadvertently show this safety valve used in conjunction with the tender cylinder in a cut illustrating a combination of high speed brake appliances with existing brake mechanisms on cars and locomotives. On the contrary this cylinder should also be fitted with an automatic reducing valve which, when supplying the apparatus for



AUTOMATIC REDUCING VALVE OF THE HIGH-SPEED BRAKE.

in Figs. 1 and 3, closing the exhaust and retaining 60 pounds pressure in the cylinder. The area of ports *a* and *b* is such that in performing the function just described they are enabled to discharge the surplus air from the brake cylinder to the atmosphere quite as rapidly at is enters the brake cylinder through a port in the slide valve of the triple valve of somewhat smaller area.

The position taken by the piston 4 and slide valve 8, in an emergency application of the brakes, is shown in Fig. 5. The violent admission of air to the brake cylinder suddenly drives piston 4 throughout its entire traverse, until it rests on spring case 3, when the apex of port *b* in the slide valve is brought into conjunction with port *a* and a comparatively restricted exhaust of the brake cylinder air takes place while the train is at its highest speed, gradually increasing as the pressure on piston 4 is lessened and slowly moves the slide valve upwards, in a degree proportional with the reduction of speed of the

REQUIREMENTS FOR EXTRA CARS NOT FITTED WITH HIGH-SPEED APPARATUS.

When occasion arises for attaching extra cars, which may not be fitted with an automatic reducing valve to high speed braked trains, some provision must be made for relieving their brake cylinders of the resulting high air pressure; otherwise, the wheels may be slid and flattened, and perhaps entirely ruined. When time admits of so doing, it is best to equip such cars in the regulation manner, with the automatic reducing valves; but if time will not permit, a small safety valve, which we supply for that purpose, may be quickly screwed into the oiling hole of the cylinder head and removed at the end of the journey. The safety valve is merely an expedient for such an emergency case as we have described, and under no other circumstances is its use advised, since a valve of this character cannot be entirely relied upon at all times to close with certainty and retain the required pressure in

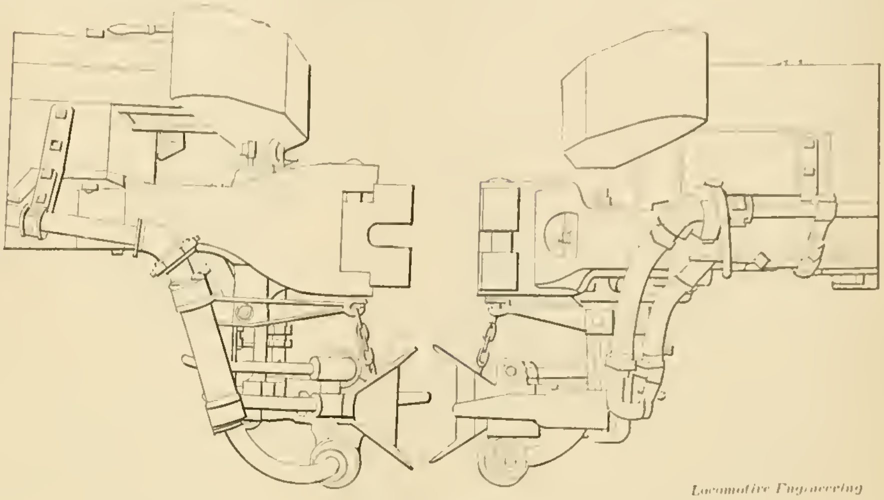
a locomotive and tender, will be included therewith at a moderate additional cost to the published charge for the fixtures.

It is advised that occasional tests be made with air gages to determine the accuracy of performance of these valves, as unauthorized persons may tamper with their adjustment. The same attention must be given their care and maintenance as to triple valves.

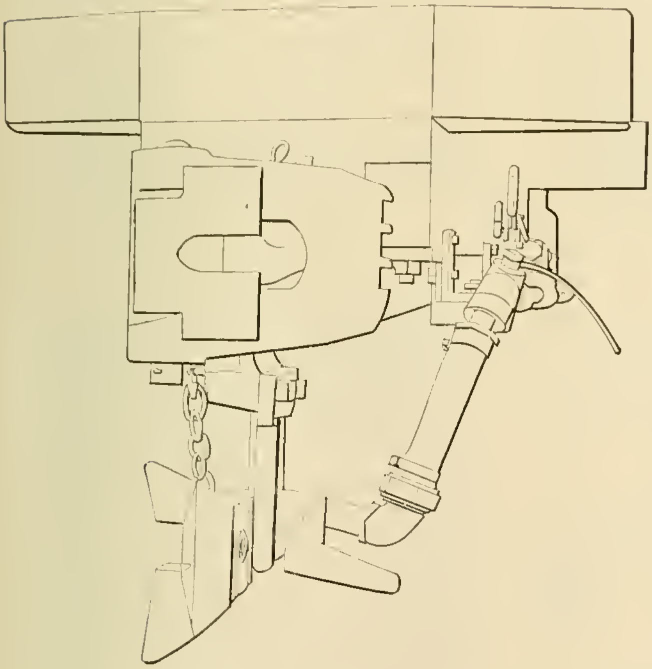
GENERAL INSTRUCTIONS.

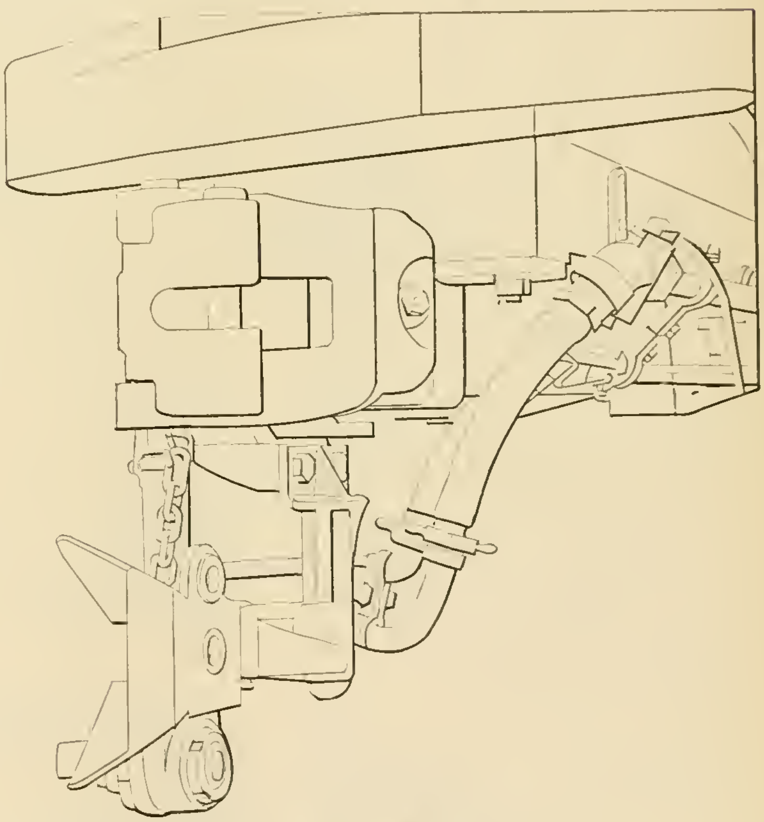
The high speed brake should be operated by the engineer precisely in the same manner as if he were operating a train fitted with the ordinary quick action automatic brake. Whatever the pressure carried in the train pipe, a reduction of 20 pounds therein will fully apply the brake and a further reduction of this pressure is merely a waste of air. As will be observed from the previous text of this publication, the auxiliary reservoirs of the cars fitted with high speed brake apparatus, when operated as a high speed braked train, are charged with a high pressure to a degree that will admit of three successive full applications of the brake, each equivalent to an ordinary full service application of the quick action brake, without recharging the reservoirs.

The high speed brake requires that the engine shall be fitted with a duplex pump governor, the diaphragm portions of which must be coupled in the usual manner with the main reservoir at the brake valve connection provided for this purpose. One diaphragm portion of this governor is adjusted to regulate the high air pressure used in operating the high speed brake; the other is adjusted to govern the pressure used with the ordinary braked train. A quarter inch cut-out cock is located in the air pipe leading to the diaphragm portion of the pump governor which regulates the lower pressure carried, and should be closed preparatory to coupling the engine to a high speed braked train. The diaphragm portion of the pump governor adjusted to the higher pressure will then govern the pressure compressed in the main reservoir; similarly the handle of the reversing cock, to which duplicate feed valves are attached and suspended under the running board of the engine, must be turned to a position which will cut in or out, as may be required, either of the feed valves, dependent upon the character of the train brakes to be operated. In one position of the reversing cock handle, the feed valve will govern train pipe pressure to 70 pounds for ordinary braked trains. In the opposite position, the feed valve adjusted to the higher pressure is cut in and governs the train pipe pressure to that required for operating the high speed brakes.



AUTOMATIC AIR AND STEAM COUPLING DEVICE UNCOUPLED.


FOR FREIGHT CARS—AIR ONLY.


FOR PASSENGER CARS—AIR, SIGNAL AND STEAM HEAT.

The Amended Air Brake and Signal Instructions.

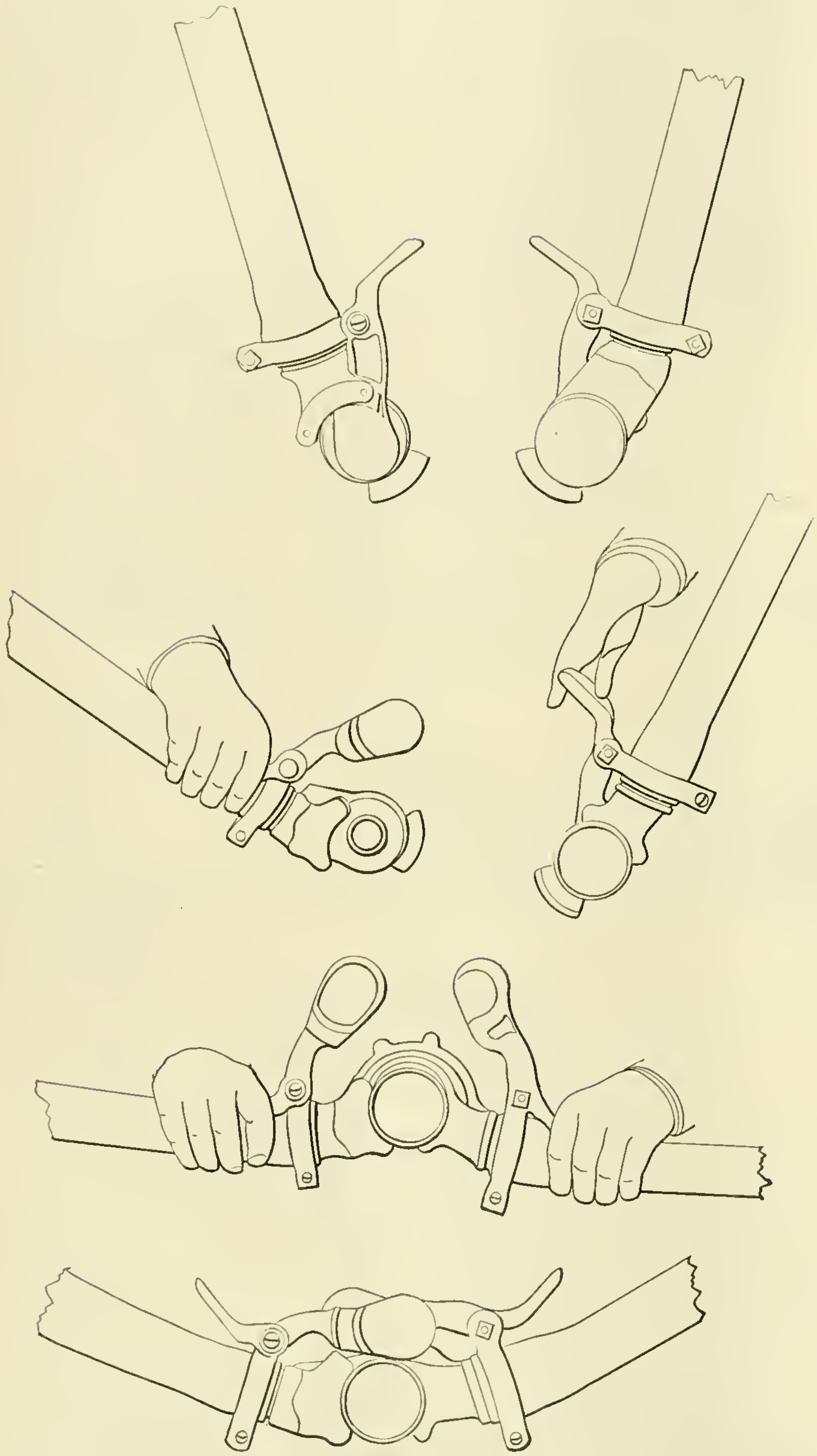
Subjoined are the most important of the amended portion of M. C. B. and M. M. air-brake and signal instructions recently made at the Old Point Comfort convention:

"Service Application.—In applying the brakes to steady the train upon descending grades, or for reducing the speed for any purpose, be very careful not to make too great a reduction of pressure in the outset, as the speed of the train will be too quickly or too much checked, and it will be necessary to release the brakes and apply them again later, perhaps repeating the operation. Apply the brakes lightly at a sufficient distance from the stopping point, and increase the braking force gradually, as is found necessary, so as to make the stop with one application, or at most two applications of the brakes.

With freight trains, first allow the slack to run up against the engine. Great care must then be taken to apply the brakes with 5 to 7 pounds reduction and not make a second reduction until the effect of the first reduction is felt on entire train, in order to prevent shocks which otherwise may be serious."

[This additional paragraph contains much of practical value, and if adhered to, will reduce the damage to lading and equipment resulting from a heavy initial reduction. Air-brake men will duly appreciate it.—Ed.]

"Cleaning Cylinders and Triple Valves. The brake cylinders and triple valves must be kept clean and free from gum. They must be cleaned and oiled as often as once in six months, upon passenger



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THE GRAVITY AIR-BRAKE DUST GUARD.

(Exhibited at the Old Point M. C. B. and M. M. Conventions.)

cars, and once in twelve months upon freight cars. The dates of last cleaning and oiling must be marked with white paint upon the cylinder in the places left for such dates opposite the words, which will be stenciled with white paint, in 1-inch letters, upon the cylinder or reservoir as follows:

Cylinder cleaned and oiled........

Triple cleaned and oiled........."

[This requires brake cylinders and triple valves to be cleaned each time they are oiled—a splendid change from the old recommendation. However, a step further might have been made by recommending grease instead of oil for brake cylinder lubricant.—Ed.]

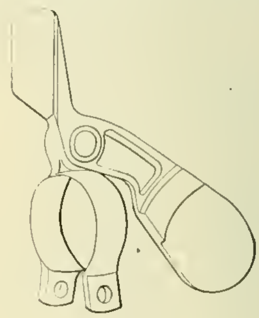
"6. Q.—Where does the compressed air come from directly, that enters the brake cylinder when the automatic brake is applied?

A.—It comes from the auxiliary reservoir on each car in service application, and from the auxiliary reservoir and train pipe in emergency application.

"49. Q.—Why should the piston travel not be permitted to exceed 8 inches on passenger cars and tenders, or 9 inches on freight cars?

A.—Because, if it travels farther than this when sent out, a little wear of the brake shoes will cause the piston to travel far enough to rest against the back cylinder head when the brakes are applied, and this cylinder head would then take the pressure, instead of its being brought upon the brake shoes."

[The reason given for a limited travel is a good one; but it would seem that the limit should be considerably lower and uniform on all vehicles—say, 7 inches on tenders, passenger and freight cars. It has been demonstrated in practice that a



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brake piston adjusted to travel 9 inches when car is standing, will travel as much as 10½ and 11 inches the first time the brake is applied when the car is running. The "lost travel" or lost motion in the brasses, boxes, journals, bolster, center bearings, etc., causes this increase. If the total leverage on the car is high, the increase, or "running travel" is greater. If it is low, it is less. On a moderately old freight car, braking to 6,000 pounds on each beam, and the piston travel adjusted to 9 inches, "standing travel," the brake piston would bottom against the cylinder head when ⅛ inch had been worn off the brake shoes. A 9-inch travel is too long. —Ed.]

"55. Q.—Why should the piston rod on the air pump be kept thoroughly packed?

A.—To prevent the waste of air and steam."

[The belief was once prevalent that the greater part of the water finding its way to the main reservoir and train line came from leaky piston rod packings of air pumps. To test this supposition the W. A. B. Co. placed two 8-inch pumps in test and ran them unceasingly for 142 hours. One pump was placed in its usual upright position. The other was placed upside down. The packing in the stuffing boxes was quite loose in both pumps. At the end of the test the water found in each main reservoir was weighed. That in the former weighed 25 pounds and 10 ounces. That in the latter weighed 25 pounds 8 ounces, or a difference of 2 ounces in favor of the inverted pump.—Ed.]

"58. Q.—What regulates the train pipe pressure?

A.—The pump governor, with D-8 valve, and the feed valve attachment with the E 6 or F 6 valve."

"63. Q.—What does the feed valve attachment of the E 6 or F 6 engineer's valve accomplish?

A.—When properly adjusted it restricts the train pipe pressure to a maximum of 70 pounds, with the engineer's valve in running position. When this valve is used the pump governor is attached to main reservoir pressure, and may be set to carry whatever pressure is desired therein."

"114. Q.—What is the air signal for, and how is it operated?

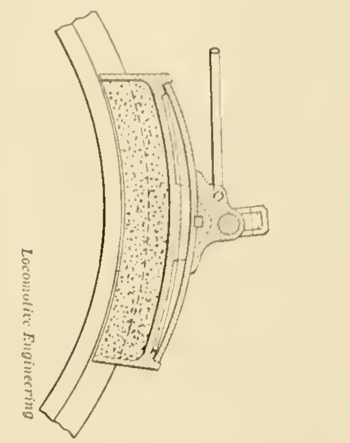
A.—It is to signal the engineman, in place of the old gong signal, and it is operated by pulling directly downward on the cord, and releasing immediately, allowing one full second to elapse between pulls."

[This should be remembered by the man who seems to believe that the harder and longer he pulls on the cord the better signal he gives.—Ed.]

The High Speed Brake.

We are pleased to present to our readers this month the new High Speed Brake, about which so many queries have come from correspondents, and to the character of which there has been much speculation. Those who supposed the device was most likely a complete revolution of the present air-brake system, and a complex, intricate mechanism upon which additional trying examinations would have to be passed, will be surprised and pleased to learn that it is merely a few simple parts added to the standard quick-action form. The wonderful increased stopping efficiency has been obtained with surprising little change and a few simple additions.

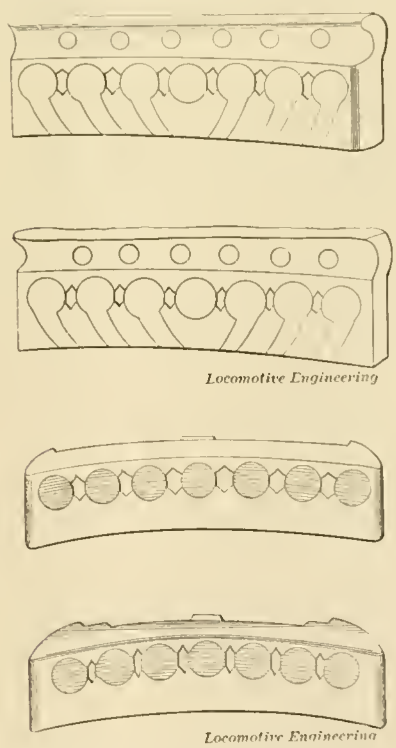
The air-brake man has noted with much interest and concern the high speeds attained by competing express trains on the leading railways during the past few years. He shares the feeling of other railway men who are proud of these remarkable achievements, but standing out clearly from others in his mind are the questions: In what condition were the air brakes on these trains? In what distance could the train at such terrific speed be brought to a stop with the brakes? He begins to calculate the probable distance, and his figures alarm him. He runs over them again to be assured of their correctness, and hopes to goodness that nothing more substantial than atmosphere will ever have the ill luck and bad taste to argue right of way with one



THE KINZER COMPOSITION-FILLED SHOE—SECTIONAL VIEW.

of these flyers for at least half a mile after the emergency brake has been applied.

The ordinary passenger prefers to ride fast. He will pay extra fare to ride on a train which will get him to his destination a fraction of an hour earlier. He thinks of no other stops than his destination. But, if this passenger were given a seat on the engineer's or fireman's box in the cab, and at a speed of 50 or 60 miles per hour, he would see about six trains lengths ahead on the track, a caboose or other inharmonious piece of railway furniture, how many extra fares would he not pay to be assured that the train would be stopped before striking the object? He would probably begin with one, and as the object assumed those increasing proportions with a rapidity and familiarity known only to those who have been obliged to face such situations, he would probably offer all he possessed and all he could borrow before the last two train lengths had been covered. If he escaped with but one opinion, that one would doubtless be that it is quite as important to be able to stop a train quickly as it is to attain high speed.



THE COMPOSITE BRAKE SHOE COMPANY'S CORK INSERT SHOE.
(Shown at M. C. B. Convention.)

Now that there is a lull in high speed competition, and the results reached seem satisfactory (for the present at least), would it not be interesting and advantageous to inaugurate a series of competitive air-brake stops on passenger trains? The air-brake trials have given us the length of stops at different speeds, but how many ordinary railway trains are to-day approaching these figures?

Criticisms on Willett's Duplex Air-Brake System.

In response to the invitation to our readers to write us their friendly criticisms on Willett's Duplex Air-Brake System, published in our June issue, the following principal communications have been received.

Mr. Otto Best, of the N. C. & St. L. Ry. at Nashville, Tenn., writes as follows:

"Replying to your invitation to criticise the Willett duplex system in a friendly way I would say that,

1. It is not quick action, and could not apply quick on a long train.
2. The engineer's brake valve has no equalizing feature. The engineer must use it like a three-way cock.
3. The quick recharging device is all wrong, see page 241 air-brake department, March number.
4. Too many stop-cocks and pipes.
5. A bad leak in one brake cylinder packing would release all brakes.
6. If the 'compound and reducing pipe' would break you would lose all your brake cylinders, and you would never know it until you tried to set your brake.
7. Piston '*d*' in the 'Duplex Valve,' is not necessary. Why not save metal and labor by using cap nut to guide piston like Westinghouse?"

John H. Wood, P., C., C. & St. L. Ry., Chicago, Ill., writes as follows:

"There are too many parts, too many changes and too few, if any advantages gained. I believe a better system would be to pipe each triple valve exhaust of the present systems into one pipe run into the cab, and have a cock on it to hold brakes on while you recharge, and to release partially if you wanted to."

Amos Judd, Boston, Mass., writes as follows:

"Please publish the following friendly criticisms on Mr. Willett's Duplex Air-Brake System, made in response to your invitation in June number.

The system shows evidence of thought and a desire to contrive something different in air brakes, even if it is not an improvement on the present form. The most serious objection to Mr. Willett's system is the fact that the system contains no quick-action feature; a fault which is very serious with the modern long freight train.

There is no way by which the train-pipe pressure can be vented at each triple valve, as is common with the present quick-action system. All the reduction of train-pipe pressure for the entire train must be made through the brake valve. This system of brakes is a great deal like the old plain automatic system and straight air combined.

It has the weakness of the old straight-air brake. It cannot be applied sufficiently quick in emergency application to prevent rear cars from running up and smashing into head ones.

If the 'compound and reducing' pipe should be broken, or the hose left uncoupled, the air that should go to the brake cylinders in an application would be lost to the atmosphere. Like the straight-air brake, no warning of the trouble would be given until an attempt to apply brakes was made, when it would be too late.

I would like to ask if Mr. Willett has tried his brake on a train of fifty cars, and also what is the time of application from the first to the fiftieth car.

No doubt one or two cars of this system would work well, but when it comes to a long train of cars, there would be many obstacles to meet which Mr. Willett has doubtless not yet contended with."

The criticism of Messrs. Best, Wood and Judd has pretty thoroughly pointed out the weaknesses of the "Willett's Duplex Air-Brake System." There is considerable more which we might say, but inasmuch as it would involve a great deal of air-brake history and the development of the air brake, we will not take it up at this time.

A successful brake must be one that can be operated on long freight trains, and consequently must be one of quick-action form. There must be a vent from the train pipe at each car in order to get a quick enough application on the entire train to prevent the disastrous shocks to the rear cars. One large opening at the brake valve will not suffice.

CORRESPONDENCE.

An Opinion Wanted.

Editors:

I would like to ask Amos Judd, through "Locomotive Engineering," what is his opinion of the Willett duplex brake. I note that he states, in June number, that the two pipe air-brake systems are plainly on the wrong side. He says the single-line system is good enough for him to handle until something better is developed; then he wants that. Has not that time now arrived?

William L. Cross,
W. J. & S. R. R.

Camden, N. J.

Driver Brake Piston Travel.

Editors:

In your May number it is stated in the notes on the 1897 Convention of the Association of R. R. A. B. M., that the writer recommended a driver brake piston travel "no less than one-third and no more than two-thirds of the stroke," instead of "no less than 2 inches and no more than 4." This is an error, as the recommendations made were directly against such an indefinite and unsatisfactory rule.

The driver brake should be one of the most powerful brakes in the train, and therefore one of the most important ones. Now, as in the ordinary stop or holding-on grade, the proportion of work done by each brake is principally dependent on piston travel, it should readily be seen from this why the limits of variation for driver brake piston travel should not be very considerable.

When it is considered that, owing to two driving-brake cylinders being supplied from one auxiliary reservoir, the actual piston travel is that of the two cylinders combined, the inadequacy of the rule of thirds becomes most apparent. Then, too, the cylinder clearance in brake release is just twice that of other brakes.

The following table gives the length of full stroke of various driver-brake cylinders used, one-third of the combined travel of two of each, two-thirds of the same and the permissible variation by the rule:

Stroke of Piston.	⅓ Stroke of two such.	⅔ Stroke of two such.	Permissible variation.
6"	4"	8"	4"
7"	4⅔"	9⅓"	4⅔"
8"	5⅓"	10⅔"	5⅓"
10"	6⅔"	13⅓"	6⅔"
12"	8"	16"	8"

It will be seen by comparison that the permissible variation would be greater than the wide margin generally allowed on freight brakes, where it should be less than with the passenger-car brake. As near as local conditions will permit, the driver brake piston travel should be such as would, with 70 pounds train-pipe pressure and full application, develop 50 pounds in the cylinders.

F. B. Farmer.

St. Paul, Minn.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(86) R. B. L., Port Jervis, N. Y., asks: Will you kindly answer the following question for the benefit of a number of your readers in this section? When train pipe pressure has been reduced more than 20 pounds, will the brakes release? A.—No. In exceptional cases however, the brake cylinder pressure on short piston travel cars could leak back into the train pipe, providing the check valve in the triple leaked, and might release the brakes on long piston travel cars.

(87) H. T., Paducah, Ky., writes: In cleaning a brake cylinder on an old second-hand passenger coach, a leakage groove was found that was over 6 inches long. Why so long? A.—This is probably an old straight air brake cylinder which originally had no groove. The person who placed the groove therein to adapt it to automatic brake service, was careless regarding the length. The length of the leakage groove should be no longer than 4 inches on both freight and passenger cars.

(88) W. A. H., Port Jervis, N. Y., asks: Why does the tender brake apply when the blow-off cock is opened on the engine to blow off steam? A.—We believe we answered this question once before. The auxiliary reservoir being charged with pressure, the heat of the steam and hot water blowing against it will raise the pressure therein, and will consequently cause a higher pressure in the auxiliary than that remaining in the train pipe, which will push the triple piston downward in the same manner as a reduction of pressure in the train pipe, and will set the brake.

(89) O. H. B., Syracuse, N. Y., writes: Is there a short rule for determining the brake power on a cam brake other than Wahlert's? If so, please give it. A.—Apply the brake with full pressure,

multiply the cylinder pressure by the distance in inches between the cam screw pins, minus the distance in inches between the cam link pins, divide that product by the distance in inches between the point of contact on the cam faces and a line drawn through the cam screw pins. This result multiplied by the total length of the hanger lever and divided by the distance between the hanger pin and brake shoe pin will give the brake power.

(90) H. T., Paducah, Ky., writes:

In your answer to question 46 in the March number, I can see why a leak in the auxiliary reservoir pressure should cause brakes to whistle off, but will you please explain why the other two causes you gave should make them act that way? A.—The equalizing piston of the brake valve becoming gummed or clogged would prevent its proper operation, and when seating it would probably descend quickly and thereby cause the surge which might release brakes even on a short train. Regarding the interim between the first and second applications, perhaps the brake would have released on the first application had you waited long enough.

(91) W. A. T., El Dorado, Kansas, writes:

The question "How do you apply the automatic brake?" is usually the first question asked railroad men by the air brake examiner. Every practical engineer and trainman knows that reducing the pressure in the train line at any point sets the brake. I think it would be more impressive if this question were followed by one something like this: "What causes the brake to set?" The answer should be "By reducing the train line pressure below the pressure in the auxiliary reservoir." Please say if I am right. A.—We can see no objections to the additional question as suggested by you, and it would probably serve to create a better understanding of the subject.

(92) H. T., Paducah, Ky., writes:

In pulling a 6-car passenger train, brakes hold and stay set until such time as I find it necessary to make reductions nearing a point of equalization, say from 15 to 20 pounds, when brakes on tender and sometimes drivers whistle off. I have looked for leaks in the auxiliary reservoir pressure, but can find none. What is the cause of this trouble? A.—It is probable that the leakage from shorter travel piston cars in your train is leaking back from the cylinder through the emergency check valve into the train pipe, and is releasing your tender and driver brakes which perhaps have longer piston travel than the cars in your train. Shorten the piston travel on your engine and tender, taking care not to get the slack up so close as to slide wheels.

(93) L. R. H., Cincinnati, O., writes:

I have heard it recommended that one drop of oil per minute is sufficient to lubricate the steam cylinder of the air pump. Is this not wrong? One drop a minute is enough sometimes—say, when the train is short, and the pipes, etc., are tight; but when a train is long and pipes leaky, should not more oil be fed to the pump than one drop a minute? A.—A regular and constant feed is a very desirable thing; but the rule of one drop per minute is not authentic or reliable. The work performed by the air pump, and the condition of the pump, must determine the amount of oil fed to it. A pump whose packing rings and valves are worn will require more oil than a pump in good condition. A pump supplying pressure to a long or leaky train will require more oil than when pumping into a short, tight train pipe, and the amount, whether it be one drop or more per minute, should be determined by the engineer running the pump.

(94) J. B. D., Arkansas City, Kansas, asks:

In making repairs on air pipes of a locomotive having the main reservoir on the back of the tender, I placed a leather gasket in one pipe to the reservoir and filled the reservoir with air from the round house supply. I found a leak and commenced to unscrew the nut connecting the pipe to the drum to take out the blind gasket. The air escaped, and as it did so it caused the gasket and nut to be covered with ice. This is very warm weather here and I cannot account for the phenomenon. I repeated the operation several times with the same results. What caused it? A.—Compressed air expanding will naturally cool. With an opening such as you probably made, ice will readily form. If you wish to experiment further you can do so by partially opening the release cock on the auxiliary reservoir charged with air pressure, and by holding your thumb nail at the aperture, ice will form thereon. This is a result which will always follow when air is expanded rapidly.

Master Mechanics' Convention.

The American Railway Master Mechanics' Association convened for the thirtieth time in its history, at 9:30 A. M. June 15th, in the splendid ball-room of the "Chamberlin," at Old Point Comfort, Va. After prayer and a short welcoming speech by the acting post commandant at Fortress Monroe, President R. H. Soule read his address, which was a remarkably clear and appropriate paper, touching on the important issues that were to receive the attention of the assembly, and tracing the development from uncertain and diverse practice to established standards in construction in the short period of thirty years. Cause for congratulation was found in the fact that the organization had grown from the devoted band of 41 who signed their names on the roll at the first meeting held in Cleveland in 1868, to a society comprising a membership of 620 in 1897.

The dates recording the beginning of what are now distinctive features of locomotive practice, were specially interesting facts to the members not having any particular talent in storing statistics for future use, coming to many of them as a revelation of greatest importance. Among these subjects was that of the preference of steel over iron in boiler construction, which was one of the live topics for discussion at the first meeting of the association in 1868, preparing the members of the second annual meeting for a report deciding emphatically in favor of homogeneous steel for all fireboxes burning bituminous coal. Of like interest was the record of steel tires of the same convention, which told of the slow movement in their favor prior to that time, but explaining that they were at that date having preference over iron tires, and were fast taking possession of the field to the exclusion of all others. Another fact in this connection that has historical value, was given in that part of the address referring to the passing of the wood burner. It was in 1870, at the third meeting, that a committee foretold the end of wood as fuel for a locomotive, and prophesied bituminous coal as the fuel of the future.

Timely remarks on the subject of higher boiler pressures, calling attention to the need of it for economy in simple engines, and the resulting increase in pressures for engines of the compound type which they will be forced to assume in order to maintain their status as fuel savers. The piston valve was thought to be meeting with increased favor as the result of the leaning to higher pressures, which demanded a valve balance nearer perfection than that in use with the pressures of the past. In all particulars the address contained much food for reflection.

Treasurer Stewart, after having faithfully served the association ten years, handed in his resignation, assigning as a reason that the scene of his duties was so far distant from the places chosen for the meetings of the executive committee, of which he was a permanent member, that he could not always conveniently attend the meetings, and therefore felt it to be to the best interest of the association that he resign the office. In rendering an account of his stewardship, Mr. Stewart made a comparison between the affairs of ten years ago, when $16 constituted the cash on hand, out of which the secretary's salary had to be paid, and the present session, which had a balance of $1,659 dollars and no debts.

The amendment to the constitution, which was noted at the Saratoga convention, and reading, "The officers of the association shall be a president, first vice-president, second vice-president, third vice-president, treasurer and secretary, and they, with the exception of the secretary, shall constitute the executive committee," was adopted in due form. This creates the office of third vice-president, and makes a difference in the personnel of the executive committee, the newly-made officer taking the place of the secretary, who is no longer a member of the committee.

The question of the association scholarship caused a great deal of discussion for the reason that a strange apathy seemed to exist among those properly eligible to its benefits, and the proposition to enlarge the list of those entitled to tuition, so as to embrace the sons of all railroad employés, caused a talk of some little warmth; there being a wide difference of opinion, which was freely expressed, as to the justice or propriety of such action. It was finally voted to make the scholarship available to all employés of machinery departments, and their sons.

A motion to condense the sessions of both conventions into one week, was read by Mr. Lewis, as follows: "Several prominent members of both the Master Mechanics' Association and the Master Car Builders' Association have expressed the belief at these conventions that both conventions should be held in one week. In view of this sentiment, and in consideration of the treatment which the same question has received by the president in his able address, and in order that the matter may be tried for one year, if it is possible to effect such result, I move: First, That the executive committee be empowered to fix the days of the convention of this association in June, 1898, and the hours of the day, regardless of the provisions of the by-laws. Second, That the executive committee of this association be also empowered to select members of the association to act with it in this matter, so as to make eleven in all, and that it be instructed to request a joint meeting of the eleven with the eleven members of the executive committee of the Master Car Builders' Association, to consider this question and endeavor to arrange the details, so that both associations may finish their convention work in one week in 1898. The question as to holding one joint opening session in 1898 to be left in the hands of this joint committee to be determined according to its best judgment." The motion was carried and referred to the executive committee for action.

Another motion, in harmony with the above, for a more profitable utilization of the time at conventions, was made by Mr. Forsyth, who favored a little mental pabulum at the conventions in the form of an address on a technical subject, to fill in the evenings, by some prominent member of the railway, college or engineering profession. The motion was adopted.

The discussion of the piston rod question brought out some light on the matter of hollow rods, as well as the solid ones;

of a diversity of materials, among which nickel steel had been found to be quite satisfactory; also high carbon steel standing well to the front, in point of favor.

Compound and simple locomotives was a topic that received better treatment at the hands of members than was expected by most of those present, for the reason that the sentiments expressed were so radically different from those that have been heard in curb-stone discussions of the subject. Mr. Morris opened the case with a well prepared paper containing a comparative statement of the performance of one compound against ten simple engines, identical in all respects, except in compounding cylinders, the comparison extending over a period of four years. The report was a flattering testimonial to the economy of the Richmond compound engine. Mr. Vauclain stated that the tendency to use more compounds was plainly evident, and cited some figures to substantiate his remark. He built 173 in 1896, and had turned out something like 800 up to the present.

Exhaust nozzles and steam passages were brought out by Mr. McIntosh who opened the themes, and, in his clear style emphasized the necessity of keeping an accurate account of changes made in smoke-box appliances when investigating the effects of different adjustments of the parts. This precaution would be found to be very necessary in order to avoid going over the ground at a waste of time, because of the extended range of adjustment that will produce good as well as bad results.

The value of testing plants was well shown in the subject under discussion, by Mr. Herr who stated that his experience with the design of exhaust passages, tips and stacks recommended by the committee was obtained on the Northwestern testing devices, and he was putting in practice on his Northern Pacific engines the results of his experiments at that time. A well defined unanimity as to the merits of the work of the committee was prevalent, the consensus of opinion of all who took part in the discussion seemed to favor their recommendations, and in few cases were there anything but good reports.

Mr. Sinclair believed that there were elements outside of the steam generating appliances that may account for the working of an engine with a very large nozzle showing less economy than with a smaller nozzle, and cited the case of Mr. Martin who experimented a number of years ago very largely with exhaust nozzles, and found when he reached a certain degree of opening that economy ceased. He used the indicator in these tests, and concluded that the vapor went out of the cylinder when using the large nozzles, to the extent that there was not enough left confined to cause sufficient compression to fill the clearance spaces. There seems to be an impression that it is impossible to get a nozzle too large; the practice of making nozzles smaller has cultivated that idea, but now when the tendency is to make nozzles as large as possible, it ought not to be forgotten that there is a possibility of carrying a good thing to extremes.

Mr. McConnell gave some interesting figures concerning the work done by his engines, which were not equipped in accordance with committees' recommendations, but using diamond stacks exclusively. He reported a great improvement in tonnage hauled, running 2,083 less trains in 1896 than 1895, but pulled 3,700 more cars and burned 19,000 less tons of coal in that performance.

Mr. McKenzie stated that while he had heard a great deal about the choke in the stack, there was nothing about the size of cylinder, and enquired whether the choke was the same for a 15-inch cylinder as that for a 19-inch cylinder. He believed the choke should be regulated in connection with the heating surface.

A marked improvement in steaming of engines with an equally apparent economy in fuel consumption has been noted since tests on nozzle proportions and positions were instituted, and Prof. Goss in his remarks covered much comprehensive ground when he said: "The great thing which has been accomplished by the committee is the placing of limits and the deductions of laws by means of which a draft appliance may be designed with a great degree of certainty, and even though these appliances are not better than some others which may be in use, the work of the committee is justified."

(To be continued.)

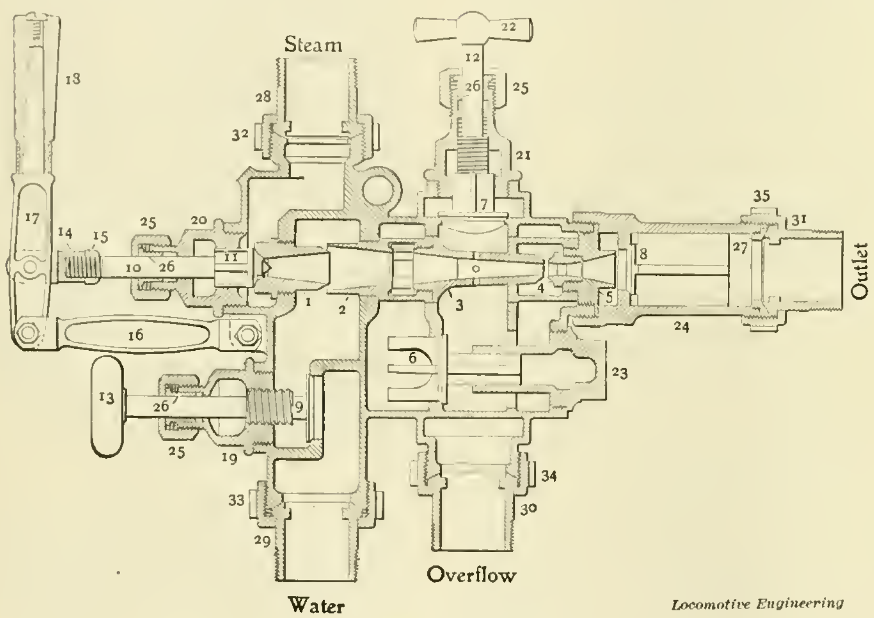
The K. C., P. & G. Ry. has applied McKee slack adjusters to 400 new box cars recently built for that system by the Missouri Car & Foundry Company, St. Louis.

The latest addition to the "Four Track" series is the new edition of "Two to Fifteen Days Pleasure Tours" for those of us who have to take vacations on the fly. It gives quite a variety of inexpensive trips and much information about the places mentioned, making the visit (if you are fortunate enough to go) doubly interesting. Ten cents in stamps sent to Mr. Geo. H. Daniels, G. P. A., Grand Central Depot, New York City.

Jenkins Brothers, 71 John street, New York, have issued their 1897 catalog of valves, packing and other specialties. Most of their goods are too well-known to need mentioning, but they are calling particular attention to the Excelsior straight-way back pressure valve which they are now handling and which seems to have several advantages.

Lunkenheimer Automatic Single Tube Injector.

The Lunkenheimer Injector here illustrated is an automatic, single tube machine of the fixed nozzle type. By "automatic" is meant that should the machine stop forcing (due from interruption of steam or water supply) the injector would restart without attention as soon as the supply is resumed. When the injector "breaks" from stoppage of water supply, the steam will not go down the suction pipe, thereby heating the water and rendering it too hot to work, or where supply is taken through meter injuring same, but will blow through injector into the atmosphere, thereby creating a strong draft through the machine, and when the water supply is resumed it will come up to the injector, which will start at once to force it into the boiler without any attention from the operator.



LUNKENHEIMER'S INJECTOR.

Many injectors are claimed to be automatic in action, but few are really so, and most of those which do approach an ideal performance of this feature soon wear out, the part which makes them automatic, i. e., the check valve closing overflow chamber between water lifting and combining tubes, cuts out or scales up. In the Lunkenheimer Automatic Injector this valve is so made that it will not cut out, and even though it should not be perfectly tight it will not materially impair the working of the machine. It has no delicate or complicated mechanism, the several parts are large and easy of access for examination and repairs without the use of special tools to remove same. Owing to its construction the injector will start promptly at all steam pressures from 30 pounds up to 250 pounds and higher on lifts not exceeding 18 feet. It is not necessary to prime the injector in starting it, as the single movement of the lever is sufficient to admit steam and the water is promptly lifted to the injector, which will at once start to work and force it into the boiler. The injector has been put upon the market by the Lunkenheimer Company, Cincinnati, O.

The Westinghouse Machine Company, Pittsburg, Pa., have issued a booklet called "Westinghouse Steam Engines." This is got up with their customary high grade illustrations and paper, and is a good example of modern catalog work. It deals largely with the economy of the engines and gives the results of several tests.

A water line indicator which seems to be very convenient for the engineer, is being introduced by Jerome V. Dorney, 10 Cortlandt street, New York. It is the Wells' patent, and consists of a light brass frame containing white porcelain blocks which go behind the gage glass. The portion of the gage glass which is filled with water shows as a broad white strip, while above the water it is simply the width of the hole in the glass. This enables the hight of water to be seen at a glance.

The Richmond Locomotive & Machine Works, Richmond, Va., have issued an attractive booklet regarding their compound, telling where and how it is used. It contains much information concerning compound locomotives, especially of the two cylinder type and has a description and chart of the valves of the Richmond compound, which are especially valuable. By means of five small leaves, the intercepting and reducing valves are clearly shown in their various positions.

Graphite Lubrication.

"Locomotive Engineering" will hold this column open for a time to the subject of graphite lubrication.

The Joseph Dixon Crucible Company, of Jersey City, N. J., have for months been advocating the use of pure flake graphite for lubricating all open or loose bearings. The Dixon Company do not contend that pure flake graphite will take the place of oil or grease, but the Company does claim that a very small portion of pure flake graphite will largely increase the lubricating value of any oil or grease to which it may be added.

Some years ago, in a series of tests made by Professor R. H. Thurston, the Professor demonstrated that, under the same number of pounds pressure and traveling at the same rate of speed, sperm oil containing a small amount of Dixon's Pure Flake Graphite was capable of performing three times more work than the same oil without the graphite. In a test, with the best quality of lubricating grease, it was shown that when 15 per cent., by weight, of Dixon's Pure Flake Graphite was added, the bearings on the testing machine were run nearly six times longer at the same high rate of speed. Furthermore, when the graphite was used there was no cutting and the bearings were in perfect condition.

At a meeting of the American Society of Mechanical Engineers, Professor Albert Kingsbury, Durham, N. H., read a paper on "Experiments on the Friction of Screws." The tests were made by the aid of a specially designed machine built at the New Hampshire College Shops.

The author did not consider that the tests showed that any one of the metals developed less friction than any of the others; but the tests are specially interesting because of the great lessening of friction by means of graphite. When graphite was added to heavy machinery oil, the friction was a little less than one-half of that shown where the oil alone was used.

In view of the splendid results which so many have obtained by the use of a small portion of graphite added to oils or greases, we believe that it will be interesting to have some brief discussion on the subject, and, as above stated, this column is open to those who desire to ask questions, and those who have used graphite are invited to state their experiences.

So little of the commercial graphite in the market is fit for lubricating purposes, and bearings have been so frequently ruined by the use of such graphite, that experimenters are cautioned to use care, and see that only pure flake graphite is used.

A hand car has been patented, by Wm. N. Rousey of Graybill, Texas, which drives through the medium of a huge spring on the order of a clock spring. This is wound up by the operation of the handles. We do not believe there will be an overwhelming demand for this type of car, as it must be evident that the more mechanism that is introduced between the application of the power and its use, the more the internal friction will be and the more power will be required to run it. Power cannot be gained by the introduction of gears and springs, but it can sometimes be saved by doing away with them.

"Rainbow Packing" is the name of an illustrated catalog recently sent out by the Peerless Rubber Manufacturing Company, New York, showing up the most recent improvements they have made in their packing. Those who are interested in steam packing will find this pamphlet a good one to refer to.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have just received a large order from the Government for lathes, shapers, drill presses, etc., to be used on the United States dredge boats in the Mississippi River.

The value of one pound of coal at different epochs in steamship evolution has been strikingly stated by Mr. A. J. McGinnis, president of the London Engineering Society. In 1840 a pound of coal propelled a displacement weight of 0.578 ton 8 knots; but the earning weight was only one-tenth of this, as 50 per cent. of the displacement represented the machinery and fuel, 40 per cent. of the hull, and 10 per cent., or 0.057 tons, the cargo. In 1850, with iron vessels and the screw propellor, a displacement weight of 0.6 ton was propelled 9 knots by the pound of coal; but the proportion of cargo had risen to 27 per cent., or 0.16 ton. In 1860, with high boiler pressure and the surface condenser, 0.82 ton displacement was propelled 10 knots, and the cargo was 33 per cent., or 0.27 ton. In 1880 the compound engine was in full swing, and 1.8 tons displacement was propelled 10 knots, and the cargo was 50 per cent., or 0.9 ton. In 1880, in the freight steamer, 2.1 tons displacement was propelled 10 knots, with still 50 per cent., or 1.05 tons of cargo. In 1895 there were two classes of freight boats. The "tramp" propelled 34 displacement tons 8½ knots, with 60 per cent. or 2 tons of cargo. At the same time, the huge cargo steamers of the North Atlantic were driving a displacement of 3.14 tons 12 knots with 55 per cent., or 1.7 tons of cargo. On the express passenger steamers, the cargo weight is down to 0.09 ton per pound of coal.

Queen Victoria's Jubilee appears to have stirred the hearts of every member of the British Isles to testify in some way their admiration for the old lady, who has reigned so happily for sixty years. The manifestation of patriotism displayed by Mr. F. W. Webb, of the London & Northwestern, has been in painting his engine, red, white and blue. We think the effect must have been very striking, to say the least of it.

"Wonderland, '97" is the attractive title of a very attractive book issued by the Northern Pacific Railway and which can be obtained by sending six cents in stamps to Mr. Charles S. Fee, general passenger agent of the above road, at St. Paul, Minn. The text is interesting, the illustrations admirable and we can't imagine a person who wouldn't get at least twelve cents worth of enjoyment from its pages, even if they never saw the places themselves. You can't double on your investment any easier than this. The chapters on "The Great Northwest," "The Yellowstone Park" and "The Heart of the Olympics" are particularly fine and make one feel that this much abused old earth is a pretty good place to be in after all.

The department of mechanical engineering of the University of Minnesota, appears to be making a specialty of training for railroad engineering under the charge of Prof. H. Wade Hibbard. We have received a circular, containing particulars of their line of instruction, which will be of much interest to those who have any idea of obtaining instruction in railway mechanical engineering. Persons interested can obtain copies of the circular by applying to Prof. Hibbard, University of Minnesota, Minneapolis, Minn.

Whenever the Queen has journeyed through France, during the past ten years, to take up her temporary home by the shores of the Mediterranean, her safety upon the French lines has been entrusted mainly to M. Chardon, the capable chief traffic manager of the Chemin de Fer de l'Ouest. He takes charge of the Royal train at Cherbourg, and remains at his post until Nice is reached. M. Chardon has the reputation of being a severe disciplinarian. Passing through a little station in Brittany some time ago, by a night train, he gave the porter in charge a regular "wigging" for not calling out the name of the place distinctly. The man, having no knowledge of the fact that he was addressing his official chief, replied, "You can't expect to get tenors for twenty francs a week." It is to the credit of M. Chardon that the retort was accepted in good part.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(48) R. J. B., Chicago, Ill., writes:

We have some engines that give a great deal of trouble with hot boxes, the weight on journals being excessive. I have been told that bearings made of "tinite" are noted for running cool under heavy loads. Can you give me a recipe for the mixture or tell where the alloy is made? A.—We never heard of the alloy mentioned, but presume it is a mixture of tin and copper.

(49) F. Y. L., Utrecht, Holland, writes:

Being a subscriber to your paper, I beg to ask you to give in your paper the circumferential velocity of the parts to be rolled, and that of the roller referred to in your editorial on page 311, entitled "Rolled finish on cylindrical surfaces." A.—The speed for rolling as practiced by many is about 20 feet per minute, but it may be increased to 30 or more without injury to the roller which is about 1½ inches wide by 3 inches in diameter. 2. What is the address of the "Locomotive Firemens Magazine," what are its terms, and is it a monthly or weekly paper? A.—It is a monthly, published at Terre Haute, Ind., at one dollar per year.

(50) W. A. T., El Dorado, Kan., writes:

I am running an engine, Grant pattern, 16 x 24 cylinders. This engine carries water very badly, while others of the same class do not. I run this engine several years ago when it had a double-dome, and at that time she carried water all right. The front dome has since been removed and the engine is now the most troublesome about raising water that I ever run. Every engineer that has handled the engine complains about its raising water. What would you suggest as the reason for this behavior? A.—The engine probably has a straight boiler and one so small as to have insufficient steam room. If this is the case the simplest remedy will be to replace the removed dome and have the benefit of its volume for steam storage.

(51) M. B. P., Rockwood, Tenn., asks:

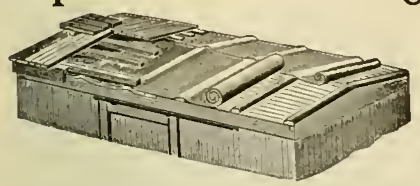
Is it advisable to use a 2½ inch pop valve, bushed down to 2 inches on a narrow-gage locomotive having 12 x 18 inch cylinders? If not, why? A.—It is not possible to answer the question asked because of a lack of essential particulars, among which the quantity of water evaporated in a given time is the important item. The size of cylinder has no bearing in the case. Mr. Frank Hemenway, one of the best practical authorities on the subject of pop valves, gives a formula for determining the area of safety valves in the "American Machinist," of March 11th, in which the maximum amount of coal consumed per hour on each square foot of grate is taken as the controlling element. The United States supervisors allow an area of 1 square inch of the valve to 3 square feet of grate surface, in the case of spring loaded valves.

(52) Subscriber, Cloverport, Ky., writes:

Will you kindly inform me about what power would have to be exerted on the periphery of a 26-inch engine-truck wheel, to turn the same on the axle; the wheel being bored out straight, with a wheel seat 7 inches long and 5 inches diameter, put on under hydraulic pressure which gradually increases until, when the wheel is in its proper place the gage shows 35 tons pressure. A.—It is well-known that the force required to start a wheel from its seat after being pressed on exceeds the force by which the wheel was put to place, but just what the amount of the increase should be is not known. An approximation to the force can be had by equating the force which acts on a lever arm 13 inches long, to the resistance 70,000 pounds, acting on a lever arm 2.5 inches long. Putting R for resistance and P for force, we have: $2.5\ R = 13\ P$, and $P = \frac{70,000 \times 2.5}{13} = 13,462$ pounds at the periphery of the wheel to overcome the resistance of 70,000 pounds on the wheel fit. This will place the force and resistance in equilibrium by figures, but as stated above the force required must be greater than this to effect movement of the wheel.

(53) McD., Waycross, Ga., writes:

Will you please inform me through your paper whether or not a parallel rod pounds or knocks? This question has been raised several times, and nearly all engineers here claim that a parallel rod will pound, while all machinists say that it will not. I claim that a parallel rod cannot pound, no matter how much larger the brasses or bushings may be than the pin. A.—When the peculiar conditions of service of a side rod are considered, it will be seen that it is impossible to have the brass fit the pin without imposing stresses that must be avoided. Unequal diameter of tires due to wear, low joints in the track, also pins out of tram, make it very necessary that side rod brasses be larger than the pins. While a pound always implies looseness of fit, or lost motion, it does not necessarily follow that it exists in properly fitted side rods, and while there is a well defined rattle on rods loosely fitted up, owing to their lateral motion on the pins, it must not be confounded with a pound. There can be no pound in side rods when put up right and the pins are in tram. See Sinclair's "Engine Running and Management."



The Sargeant Company, 675 Old Colony Building, Chicago, send us several fac-similes of letters received from parties using their steel castings. Among them are letters from the Gates Iron Works and Fraser & Chalmers, both of Chicago, who speak very highly of the uniform good quality and strength of the castings used.

The Boston & Maine people have recently issued an excursion book, which gives a great deal of information that will be of interest to tourists and people looking for a location where they can spend the summer holidays. Anyone interested in finding out good summer resorts ought to apply to the general passenger department of the Boston & Maine for this publication.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have just secured an order from the Indianapolis Engine Company, of Indianapolis, Ind., for an equipment of machine tools. They are just completing their buildings, and will manufacture a line of stationary engines.

If any of our readers has a bound volume of "Locomotive Engineering" for 1895, which he is willing to sell he will receive five dollars for it from Mr. H. W. English, master mechanic, Birmingham Ry., Birmingham, Ala.

A series of scientific tests were recently made by the Erwin condensing steam ram by Mr. Jacob Cloos, the well-known mechanical engineer, of Milwaukee, Wis. In the report made, Mr. Cloos says: "The relative efficiency of the pumping engines tested, was determined by the quantity of water evaporated for steam, in raising a certain number of pounds of water to a given hight. Both the water elevated and the water evaporated were carefully weighed and the results were as follows, comparing the duty of the Erwin condensing steam ram with the theoretical horse power as a basis of calculation, the test demonstrates that the ram will perform more than double the duty of any other contrivance known to me." This is certainly a most remarkable report, and indicates that the Erwin condensing steam ram has a great future before it.

The Buffalo Forge Co. are receiving a good many orders for their jet blower, to be used in connection with the forced draft necessary to burn anthracite culm. They recently finished a force draft plant for the Williamsport Steam Co., which is giving great satisfaction. The company writing about it says: "It has proved itself to us to be a great saver in fuel expense, and we would cheerfully speak well for the system to anyone making an inquiry."

In a suit brought by the Link Belt Engineering Company, of Philadelphia, against Mr. Jas. H. Mitchell for infringement of the Dodge patent, the Court of Appeals has decided that the patent was infringed. In the decision, the comment is made that the patent was novel in character and disclosed an invention of very decided merit, and was a substantial advance over mechanical constructions hitherto used in the arts to which it appertained.

The Pneumatic Engineering Co., Inc., 100 Broadway, N. Y., send us a neat pamphlet describing and illustrating their pneumatic pumping systems, which are meeting with good success in many places. One of their systems is the novel but effective Halsey pump, which forces the water by direct pressure.

The Boston Belting Co. have recently issued an illustrated catalog, showing their rubber mat and matting. It is got out in very attractive form, and is well worthy of using as a reference for those interested in this subject.

There is said to be "No fool like an old fool." There is an "old fool" in this office who has taken to bicycle riding, and anything that will help to accelerate his speed is particularly welcome. For some time he has been laboring under the chagrin that a neighbor could outcoast him on certain hills near the Orange Mountains. He lately received a notice from the Jos. Dixon Crucible Co., of Jersey City, that they had put on the market a substance called graphitoleo, which was the best kind of lubricant for chains and sprockets of bicycles. He sent for a specimen of the stuff without delay, and lost no time in giving it a practical test against his rival. He is now happy and swears by graphitoleo.

An exhibit which attracted much attention at the late mechanical conventions was that of the Houston pneumatic track-sander. We are informed by the Western Railway Equipment Company, of St. Louis, which handles this device, that it is making rapid progress into the favor of railroad men, and that orders for it are coming in very rapidly. A highly convenient feature of this sander is that it is operated by one valve for both front and back sand pipes. It can be applied to any sand-box at very small expense.

INDEX TO ADVERTISEMENTS.

Buyers' Finding List.

AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll-Sergeant Drill Co., N. Y. City.
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co. Philadelphia, Pa.
Rand Drill Co., New York.

AIR LIFT PUMPS.
Clayton Air Compressor Works, New York.

AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

AIR PUMP GOVERNORS.
Mason Regulator Co., Boston, Mass.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
Carey Mfg. Co., Philip, Lockland, O.

AXLES.
Cambria Iron Co., Philadelphia, Pa.

BALANCED SLIDE VALVES
Am. Bal. Slide Valve Co., San Francisco, Cal.
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
Peerless Rubber Mfg. Co., New York.

BENDING MACHINES.
Long & Allstatter Co., Hamilton, O.

BICYCLES.
Pope Mfg. Co., Hartford, Conn.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER COVERINGS.
Carey Mfg. Co., Philip, Lockland, O.
Keasbey & Mattison Co., Ambler, Pa.

BOILERS.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

BOILER TUBES, LOCOMOTIVE.
Allison Mfg. Co., Philadelphia, Pa.
Tyler Tube & Pipe Co., New York.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.
Manning, Maxwell & Moore, New York.
National Machinery Co., Tiffin, O.

BOOKS.
American Industrial Pub. Co., Bridgeport, Ct.
Audel & Co., New York.
Griffin & Winters, Chicago, Ill.
H. C. Baird & Co., Philadelphia, Pa.
Montgomery, Ward & Co., Chicago, Ill.

BORING MACHINES.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BUFFERS, BLOCKS, SPRING.
Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
Williams, White & Co., Moline, Ill.

CARS.
J. G. Brill Co., Philadelphia, Pa.
Lima Locomotive & Machine Co., Lima, O.

CAR COUPLERS.
Gould Coupler Co., Buffalo, N. Y.
Latrobe Steel Co., Philadelphia, Pa.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
Sams Automatic Coupler Co., Denver, Col.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

(Continued on page 588.)

BUYERS' FINDING LIST—*Continued.*

CAR DOOR FASTENERS.
National Malleable Castings Co., Chicago, Ill.

CAR FORGINGS.
Dickson Mfg. Co., Scranton, Pa.

CARS, FREIGHT.
Allison Mfg. Co., Philadelphia, Pa.

CAR HEATING.
William C. Baker, New York.
Safety Car Heating & Lighting Co., New York.

CAR HEATING HOSE.
N. Y. Belting & Packing Co., New York.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

CAR ROOFING.
Drake & Weirs, Cleveland, O.
Standard Paint Co., New York.

CAR VENTILATORS.
Harrington & King Perforating Co., Chicago, Ill.
M. C. Hammett, Troy, N. Y.

CAR WHEELS.
Ramapo Wheel & Foundry Co., Ramapo, N. Y.
Standard Steel Works, Philadelphia, Pa.

CAR WHEEL BORERS.
Manning, Maxwell & Moore, New York.

CASTINGS, STEEL.
Lima Locomotive & Machine Co., Lima, O.
Sargent Co., Chicago, Ill.

CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHANNELERS.
Ingersoll-Sergeant Drill Co., New York.

CHIME WHISTLES.
Crosby Steam Gage & Valve Co., Boston Mass.
Star Brass Mfg. Co., Boston, Mass.

COAL HANDLING MACHINERY.
Link Belt Engineering Co., Philadelphia, Pa.

COMPRESSED AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

CONVEYORS.
Link Belt Engineering Co., Philadelphia, Pa.

CUTTING-OFF MACHINES.
Armstrong Mfg. Co., Bridgeport, Conn.
Newton Mach. Tool Works, Philadelphia, Pa.

CRANES.
Manning, Maxwell & Moore, New York.
Wm. Sellers & Co., Philadelphia, Pa.
R. D. Wood & Co., Philadelphia, Pa.

CRANK PINS.
Cambria Iron Co., Philadelphia, Pa.
B. M. Jones & Co., Boston, Mass.

CUTTING OFF MACHINES.
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(*Continued on page 589.*)

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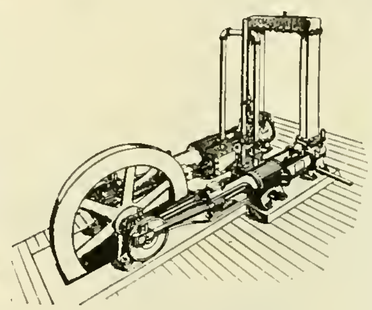

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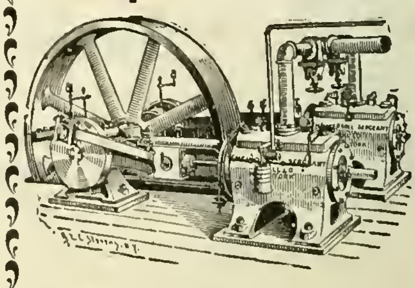

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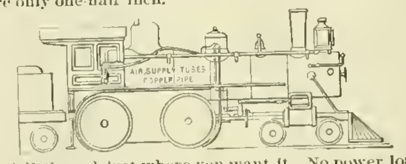

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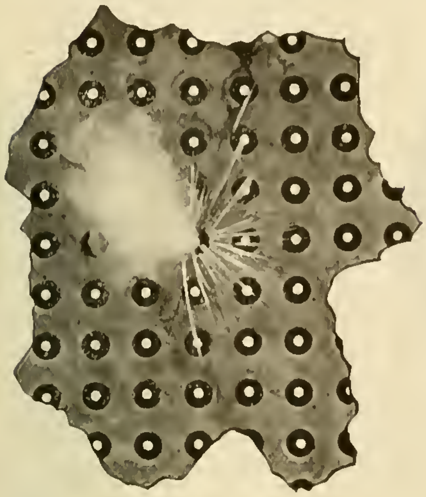

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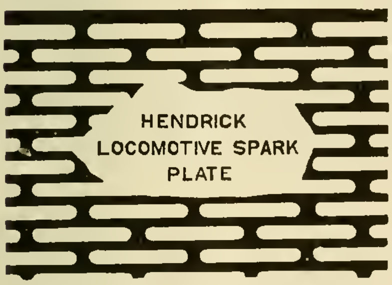

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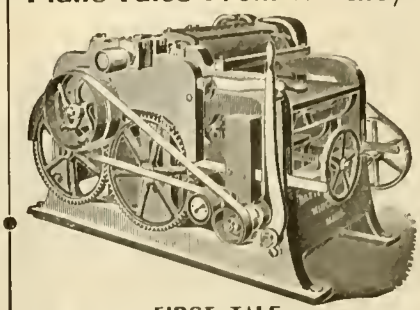

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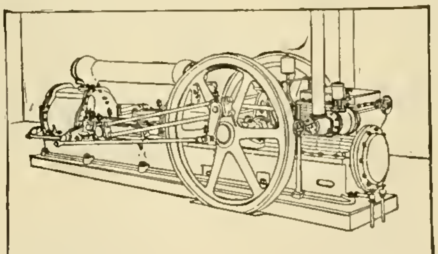

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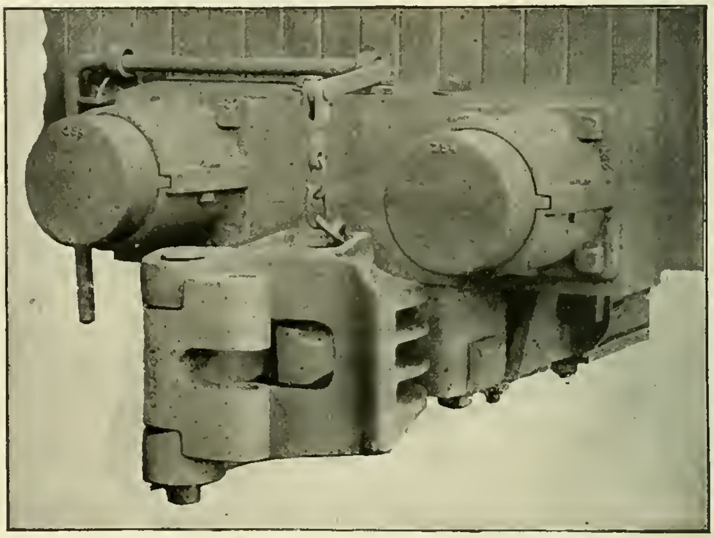

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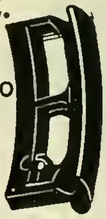

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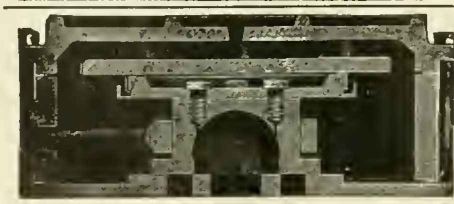

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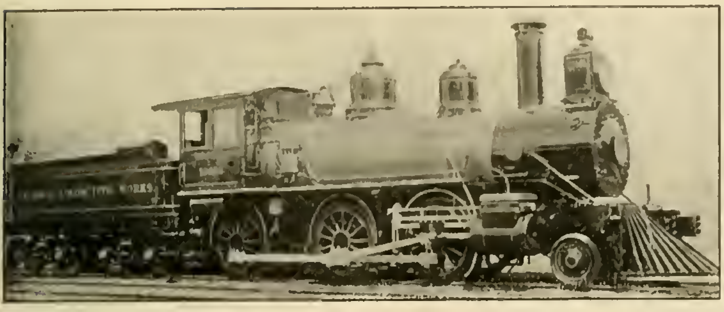

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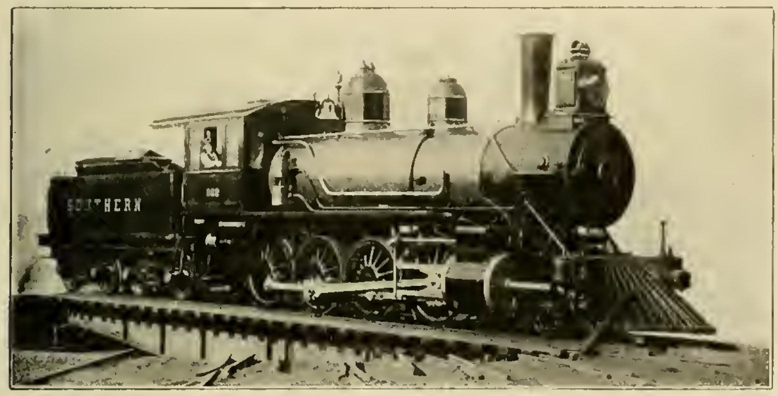

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Vol. X. NEW YORK, AUGUST, 1897. No. 8.

First Compound Locomotive Built in Canada.

The annexed photograph shows a compound ten-wheel locomotive recently built by the Canadian Pacific Railway, in the company's shops at Montreal, after the designs of Mr. R. Atkinson, mechanical superintendent. Four of these engines have been built, and the one shown is the first compound locomotive built in Canada. The compound feature of the engine is the same as used by the Pittsburg Locomotive Works, which was illustrated in "Locomotive Engineering" in February, 1894.

The cylinders of this engine are 19 and 29 x 24 inches; the driving wheels are 62 inches diameter outside of tires.

The boiler is designed to carry a working pressure of 200 pounds, and is 53¾ inches diameter at the smallest ring. It contains 216 tubes 2 inches diameter. The tubes give a heating surface of 1,310 square feet, the firebox 118 square feet, making a total heating surface of 1,428 square feet. The grate area is 28.54 square feet.

Krupp crucible tires are used; United States metallic packing; Richardson safety valves; Westinghouse air brakes and signals; Nathan lubricators; Gresham & Craven injectors; Crosby gages, and Leach's sander.

The arrangement of the smoke-box in this engine is rather peculiar, the baffle plate being placed in the front of the exhaust pipe. The exhaust pipe is rather low, being 21¼ inches above the bottom of the smoke-box. Between the nozzle and the opening to the smoke-stack there are two lift pipes, the lower one being 10 inches diameter and the upper one 13 inches diameter. The top of the latter is almost on a level with the opening of the stack.

Mr. Atkinson, writing to us about this arrangement of smoke-stack, says that it works very well and enables them to keep the smoke-box clear of cinders without spark hopper or side hole, and at the same time the engine throws fewer sparks than ever they had before, and the steaming qualities are extremely satisfactory, even with fine coal.

FIRST COMPOUND LOCOMOTIVE BUILT IN CANADA.

Shields' Ten-Wheeler.

The annexed engraving shows a remarkably well designed form of ten-wheel engine, built by the Schenectady Locomotive Works after specifications prepared by Mr. Alex. Shields, master mechanic of the Chicago, Hammond & Western Railroad. The work done by the railroad named consists principally of hauling cars between the numerous connecting lines that radiate from a point near Chicago, and it is essential that the engines should have great tractive power, combined with as short a wheel-base as possible, on account of the heavy trains to be hauled and the numerous curves that have to be traversed.

This engine has cylinders 20 x 26 inches, driving wheels 57 inches diameter, and total wheel-base of 23 feet 3 inches, of which 12 feet 6 inches is rigid. The weight on the drivers is 109,000 pounds, and the truck carries 33,000 pounds.

SHIELDS' TEN-WHEELER.

Mr. Shields, in writing about the engines, says that he received valuable assistance from Mr. James E. Sague, mechanical engineer of the Schenectady Locomotive Works, in the designing of the locomotives. A very conspicuous feature about the engine is the large heating surface. The boiler, which is of carbon steel, has a diameter of 62 inches at smallest ring. The firebox is 96 3-16 inches long, 40⅜ inches wide. The front depth is 75¼ inches, and the back depth 62¼ inches. The boiler contains 320 flues, 2 inches diameter, giving a heating surface of 2,164.21 square feet. The firebox has 153.3 square feet of heating surface, making the total heating surface of the boiler 2,317.51 square feet.

The engine is fitted with two No. 8 Hancock inspirators; Dean sander; Gollmar bell ringer, and McIntosh blow-off cock, operated by air. The engines are reported to be giving remarkably good satisfaction in performing the difficult train service they are employed upon.

Locomotive Engineers for Station Agents.

General Manager Underwood, of the Minneapolis, St. Paul & Sault Ste. Marie Railway, has adopted a peculiar plan of running his divisional points, which appears to be worthy of imitation by other railroads where there is chronic friction between the transportation and mechanical departments. It is a common thing for the transportation department to attribute delays to the mechanical department, and the mechanical department attribute, on the other hand, the blame of delays to the transportation department, through the yards being blocked, preventing engines from getting to fuel stations and to their trains.

Mr. Underwood had heard so much recrimination between the two departments, that it occurred to him that one responsible head, competent to direct the repairs and care of engines, the sw'tching and handling of train crews at the terminals and the agent's work as well would be an effective combination, and he put it into practice. He took from the engine service engineers who were considered especially capable and gave them a short course in the office, making them familiar with the duties of station agent. The rest of the work they were perfectly familiar with. These men he appointed agents in full charge of all departments at the principal division points. The plan is said to be working very harmoniously.

No Chance for Him.

All hands had been telling long stories of what they had done and would do in the event of a smash-up on the railway, with the exception of one little man, who had listened attentively to the narratives, and taken them all in without a word.

"Ever been in an accident?" asked the patriarch of the party, noticing the little man's silence.

"No," replied the little man, quietly.

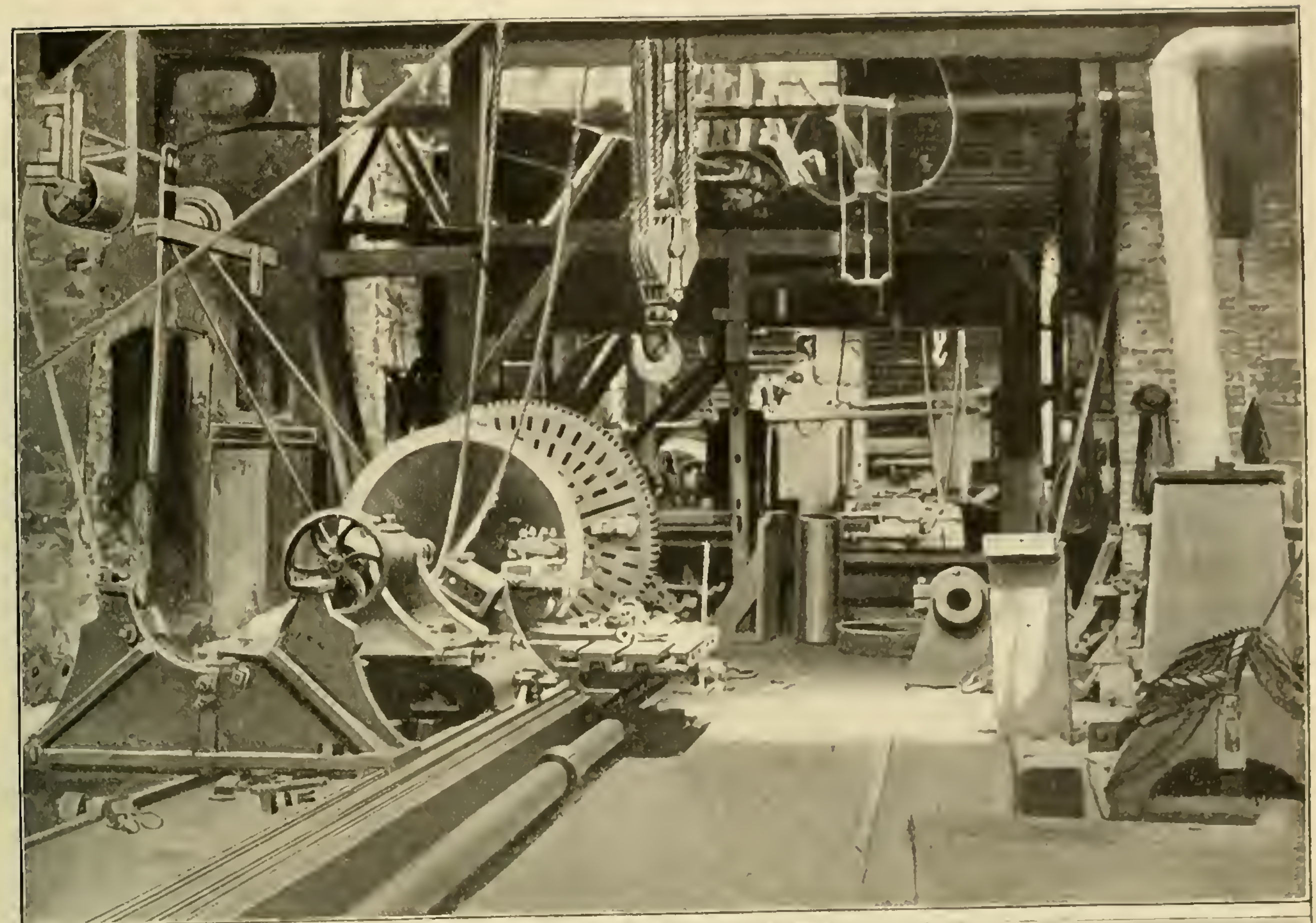
"Then you have no idea of what you would do in the fracas?" continued the patriarch.

"No, I haven't," replied the little man, sadly. "With all you big heroes blocking up the doors and windows in your hurry to get out, I don't exactly know what show a man of my size would have!"

And then there was a deep silence, so deep you might have heard a cough drop, and the little man was troubled no more about the possibility of accidents.—"Railway Herald."

The Army and the Railway in England.

It has been known for some time that a plan for an army railway council has been under the consideration of the military and railway authorities, and the details now given seem likely to give satisfaction. The Secretary of State for War has approved of the formation of a permanent Railway Council to advise as to the working of the railways in the United Kingdom on mobilization and in times of national emergency, and on questions relating to the transport of troops and stores by rail. The Council will meet at the War Office when required to do so by the Secretary of State, and during mobilization it will sit continuously. Its duties will be generally to advise the Secretary of State on railway matters, and also to draw up a detailed scheme for the movement of troops. In addition to acting as an ordinary body, it will be a medium of communication between the War Office and the railway companies. The majority of the members belong to the Engineer and Railway Volunteer Staff Corps, a valuable organization which has existed since 1860, and which numbers in its ranks the general managers of many of the large railway systems in the United Kingdom, and several well-known and distinguished civil engineers. The Council also includes all the military inspectors of railways under the Board of Trade.



WEST POINT FOUNDRY, WHERE FIRST AMERICAN LOCOMOTIVE WAS BUILT.

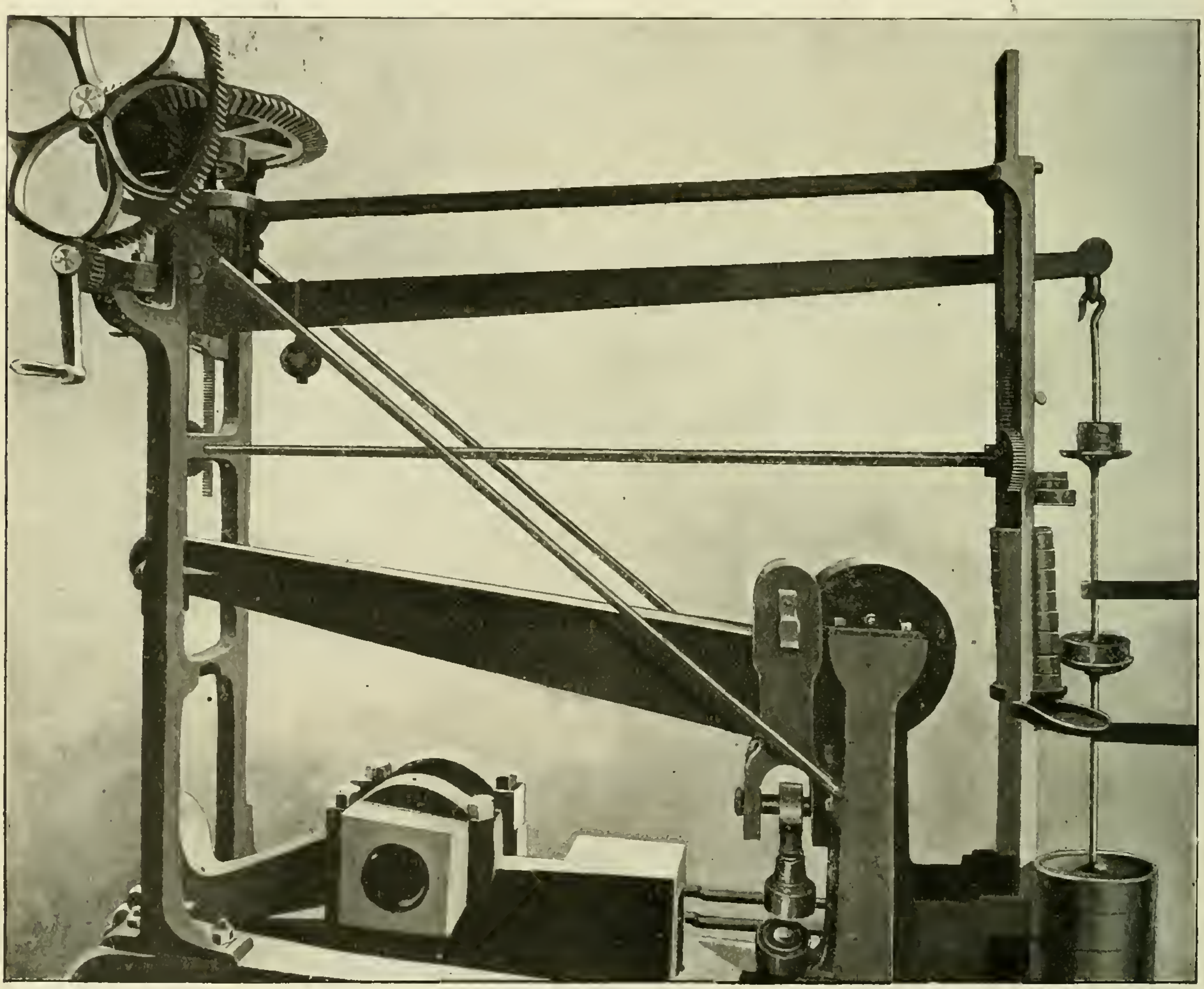
West Point Foundry.

The old West Point Foundry at Cold Spring, N. Y., lies huddled between the hills which surround it on three sides, with the Hudson river on the west, and opposite the military school, from which it takes its name. It is one of the most interesting plants in this country, by reason of its age as well as the part it took in the events transpiring between the years 1861 and 1865.

Mr. Gouveneur Kemble was the organizing spirit of the movement to locate the foundry at this place, and he moved the small belongings of his New York plant to Cold Spring in the year 1817, forming the nucleus of one of the most important ordnance works of the United States Government during the war of the rebellion. It was here that the Parrott and other heavy guns were built at the time noted above; it was here, also, that the dynamite guns were built at a more recent date, and to-day they are at work on carriages for the disappearing guns of our coast defense.

Our half-tone of the rambling collection of stone, brick and wooden structures gives but an imperfect conception of the magnitude of the ground covered by the shops, for the reason that they are built in long, parallel rows, and no one point can be found that will put all of them on the ground glass of the camera. Those shown, however, comprise the better part of the plant which consists of seven foundries and three machine shops. Two of the latter are very old, dating from the beginning of the century, while the other is quite modern in its appointments and facilities for getting out good work. The interior half-tone shows a part of the only one of the old machine shops still in operation; it gives a very good idea of the arrangement of things as they stand to-day, but while the slotter, whose frame extends across the middle ground of the picture, and the lathe of 18-feet swing in the background are hoary old-timers, the lathe in the foreground is seen to be of a fresher crop. The power for driving the tools is obtained from an overshot water wheel which is turned by a small stream coming from up among the hills. A steam plant supplements the water wheel when the latter fails to respond to all demands for power.

A testing machine, which is thought to ante-date anything of the kind in this country, was built here in the early days of the foundry, and is still used to test the tensile strength of materials. It was designed by Major Wade, of the United States Army, and built under his supervision. It is a hand-operated machine, as shown by the picture, and weighs the load directly through two levers. The power is applied through a pinion by means of a crank, to a gear that operates two bevel gears. The center of the horizontal bevel gear forms a nut through which the power is transmitted to a screw, the lower end of which is connected to the grip lever. The grips are shown in position with a broken test specimen. Shocks on the weighing lever shown at the top, were nicely provided for by a rack and pinion at each end of the machine, their function being to move a stop along with the lever so that when rupture occurred the lever simply stayed in its place with

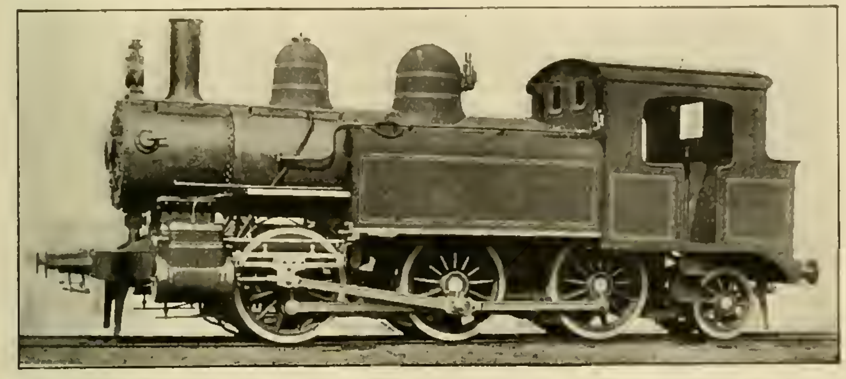


ANCIENT TESTING MACHINE AT WEST POINT FOUNDRY.

no disturbance whatever. The heavy device shown on the base of the machine is a torsional test machine, also home-made; it happened to be in that place when the picture was taken, and was left there.

This tensile-testing machine was copied by an English army officer about the year 1855, and a duplicate was built from the drawings made of it at that time. From these facts it is reasonable to suppose that it was the best machine for the purpose extant at the time. Its total pull is only about 50,000 pounds, but that was ample to test the mixtures entering into cast-iron gun construction. The old veteran has survived its usefulness as a factor in building the now obsolete type of death-dealers, but it can round out and finish its honorable career on material employed in the arts of peace, for age has not sapped its strength in the least. The old machine is worthy of preservation. It is a curiosity now, and will be a greater one a few years hence.

Few shops have had a wider or more extended experience with all branches of engineering than this. The most notable work done here, perhaps, a work that is likely to leave the most lasting impress on the minds of our readers, was the building of the first locomotive in America for actual railroad service. This engine, named the "Best Friend," was built here in 1830, and by her performance on the road demonstrated that the steam locomotive was a success for hauling freight and passengers. This engine is shown in our "Graphic History of Locomotives," on chart No. 2.



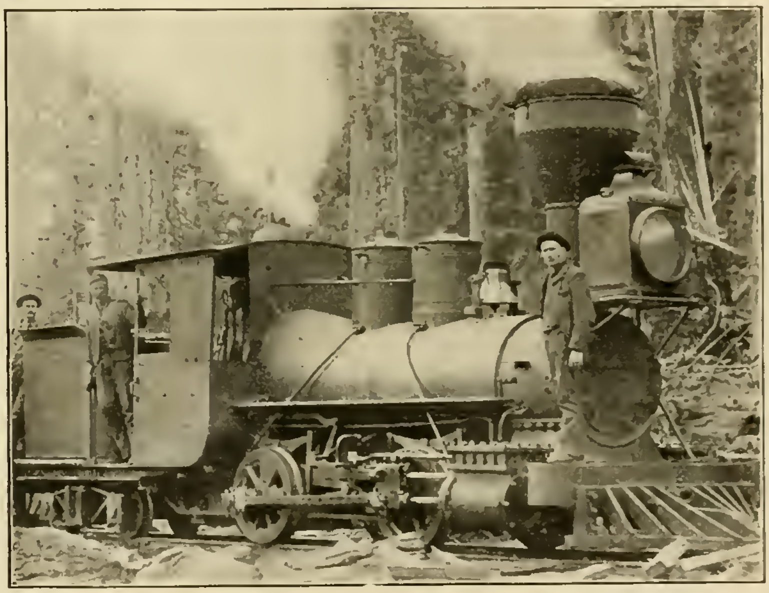
COOKE ENGINE FOR JAPAN.

Cooke Locomotive for Japan.

The annexed engraving shows a double-ended tank locomotive, one of a group built by the Cooke Locomotive & Machine Company, of Paterson, N. J., for the Boso Railway, of Japan. The engraving shows the general design of the engine so well that little description is necessary.

The engine is built for a line with 3 feet 6 inches gage. The total weight in working order is 78,000 pounds, of which 61,000 pounds rest on the drivers. The driving-wheel base is 19 feet 3 inches; the cylinders are 15 x 20 inches, and the driving wheels 54 inches diameter.

The boiler is straight, built to carry a working pressure of 160 pounds per square inch. The diameter at the front ring is 50 inches. The firebox is 68 inches long and 29 inches wide. There are 151 2-inch tubes, which give a heating surface of 783 square feet. The firebox gives 75 square feet of heating surface, making a total of 858 square feet. The grate area is 13.7 square feet.



LOGGING LOCOMOTIVE IN A WASHINGTON FOREST.

A Fifty-Cent Fizzle.

The latest put-up-job collision of locomotives occurred at Jamestown, N. Y., in a way which wasn't altogether satisfactory to the twenty-five hundred would-be spectators who planked down their little fifty cents to see the show. A huge tent had been erected, and according to programme the victims of the conspiracy were to come together in the center of the tent. But the "best laid plans" fail to meet expectations, and one of these engines got her back up and didn't make schedule time.

The onlookers had the satisfaction (?) of seeing one engine hump herself through the tent and heard the "dull and sickening thud" outside—but they didn't get a glimpse of the collision. It must be a sign of better times when twenty-five hundred people can rake up fifty cents for a show of this kind, which has lost its novelty, and which hasn't an earthly thing to recommend it.

Work at Purdue Testing Laboratory.

The new Balanced Compound Locomotive No. 1, which has been recently rebuilt at Sparrow's Point, Md., and which is the property of the Balanced Locomotive & Engineering Company of New York City, has been received at Purdue University, where it is expected it will soon be tested on the locomotive testing plant of that institution. The tests will be conducted by Prof. Goss acting under the direction of Mr. Geo. S. Morison, vice-president of the company. From the peculiarity of the design of many parts of this engine, the results of the tests will be awaited with much interest by railway men.

As is doubtless well-known the engine is of the ten-wheel Columbia type. It is a four cylinder compound, each cylinder being independently connected to the driver axle. No eccentrics are used, the valve mechanism being operated conjointly from the cross head and crank pin. The fire-box also marks a departure from the ordinary design.

Planing the Wearing Surface of Journal Bearings.

The practice of placing the comparatively rough and untrue metal of the filled bearing on the journal of a car or tender axle, has not found favor in the eyes of Superintendent of Rolling Stock J. R. Groves, of the St. Louis & San Francisco Railway. He has proved that the inevitable hump or swell on the filling is not well calculated to carry the whole load even for the short period necessary to reduce the high spot by wear.

To produce a true and smooth surface on the wearing face of the bearings, they are laid with the tops down on the planer platen, and a tool held in the tool post is made to pass over the filled surface. The tool is wide enough to cover the whole width of filling, and is made with the cutting edge to have a radius 1-32 inch larger than the journal on which the brasses are to fit. This leaves the filling with a surface true and clean to start with, at a cost for labor that is insignificant when viewed by results.

Jim Winters' Red Stack.

R. E. MARKS.

Young John Duzenbury had just been appointed superintendent of motive power of the P., X. & Q. R. R., and he wanted to introduce several changes—improvements, from his point of view—but he was cautious enough to size up the situation before he started, and wanted to know which man could be depended on to give his schemes a fair show. A few questions showed that all new devices had been put on old Jim Winters' engine; so he found Jim one day and asked him about them.

"They tell me you've had most of the new devices on your engine, Mr. Winters. What schemes have you been trying lately?"

"The last thing was a patent valve gear, Mr. Duzenbury. Great scheme it was, too. Made the '98' seem like another engine. Start! Why she'd start a train in a way 'twould make you happy for a month, and the chap that monkeyed with some sort of shiny thing out front while we was running (called his papers with marks on 'em cards, I think), said it was just what railroad men had been looking for. The thing was fine, though. Didn't have to be repaired over once a week, and saved lots of steam, too. How do I know? Why, the young fellow with the cards told me. Did I burn any less coal? Well, I can't say as I did; but the cards said we used less steam, so I suppose we must have."

"Anything else you've tried lately, Mr. Winters?"

"Yes, lots of 'em. One was a patent valve of a Boston chap; and, say, Mr. Duzenbury, that was a beauty, and no mistake. Why, the indicator man showed me his figures and proved that the '98' was making 100 horse-power more up the long hill out here than she did before the change; it takes a pretty bright chap to make a valve do that."

"Did you have any more cars than usual on when the extra power was developed, Mr. Winters; wind any stronger; run any faster; or anything else different?" asked Mr. D.

"Can't say as there was any difference, sir; but why do you ask that?"

"Nothing special, only I don't see where the extra horse-power went to. What's the use of developing 100 horse-power extra, if you don't do any more work than you did before? But see here, Mr. Winters, I have a little scheme I want to try, and as you seem to have had such good luck with the other patents, I'll put it on your engine. There won't be much, if any, change in the engine's appearance, and I don't want you to look inside the smokebox, because I want an unprejudiced test; but to distinguish the engine from the rest, for the sake of having something a little different, I'll have your stack painted red. That will make the boys wonder what's up, and we'll see what difference the new scheme makes in the engine's steaming. I believe the '98' isn't the best steamer on the road, Mr. Winters."

Well, John Duzenbury had the stack painted red, and Jim Winters began watching the steaming qualities of the "98" to find an improvement. He found it; he always did on any new device, and Jim Winters was dead honest about it, too. He wasn't "seen" or "greased" by inventors to make a favorable report. He was above that; but he was so earnest in his desire to find improvement that he usually found it—in his imagination.

He watched the "98" a week before he had a chance to tell Mr. Duzenbury of the improvement; but he made up for lost time by putting it pretty strong when he did see him. The engine was a fine steamer now, for sure.

After Jim Winters went home, Duzenbury asked young Tom Johnson, the fireman, what he thought about it, and Tom irreverently winked one eye at his superior and said softly: "Red paint on the outside of a stack don't make the '98' steam any better, or worse either. Might do on the inside; but outside—nit. I might have thought so, too, as well as Jim; but I happened to be in the roundhouse when it was done. Haven't shoveled any less coal, made any better time or hauled any more cars since your 'scheme' was tried, Mr. Duzenbury, and I don't believe we will."

"Well, don't tell Jim," said Duzenbury. "Don't want to hurt his feelings. I just wanted to be sure that he couldn't be depended on for an impartial opinion. I don't propose to make an ass of myself by having any scheme I might have pronounced a howling success on the '98,' and then get knocked cold somewhere else. I'm looking for a man who will give a device a fair trial, and yet not swear it does all the work and the engine loafs along just for company's sake. Don't want my ideas killed with either dynamite or soothing syrup. If you think of an engineer who can be fair in this matter, I want to meet him." And John Duzenbury walked away, leaving Tom Johnson a heap of thoughts to turn over in his mind. He came to the conclusion the new superintendent wore a level head, and that there were a good many engineers who would probably laugh at Jim Winters' red smoke-stack, but who were apt to be caught themselves. Only a few understand the new motto in John Duzenbury's office. It reads: "Great is the imagination of man."

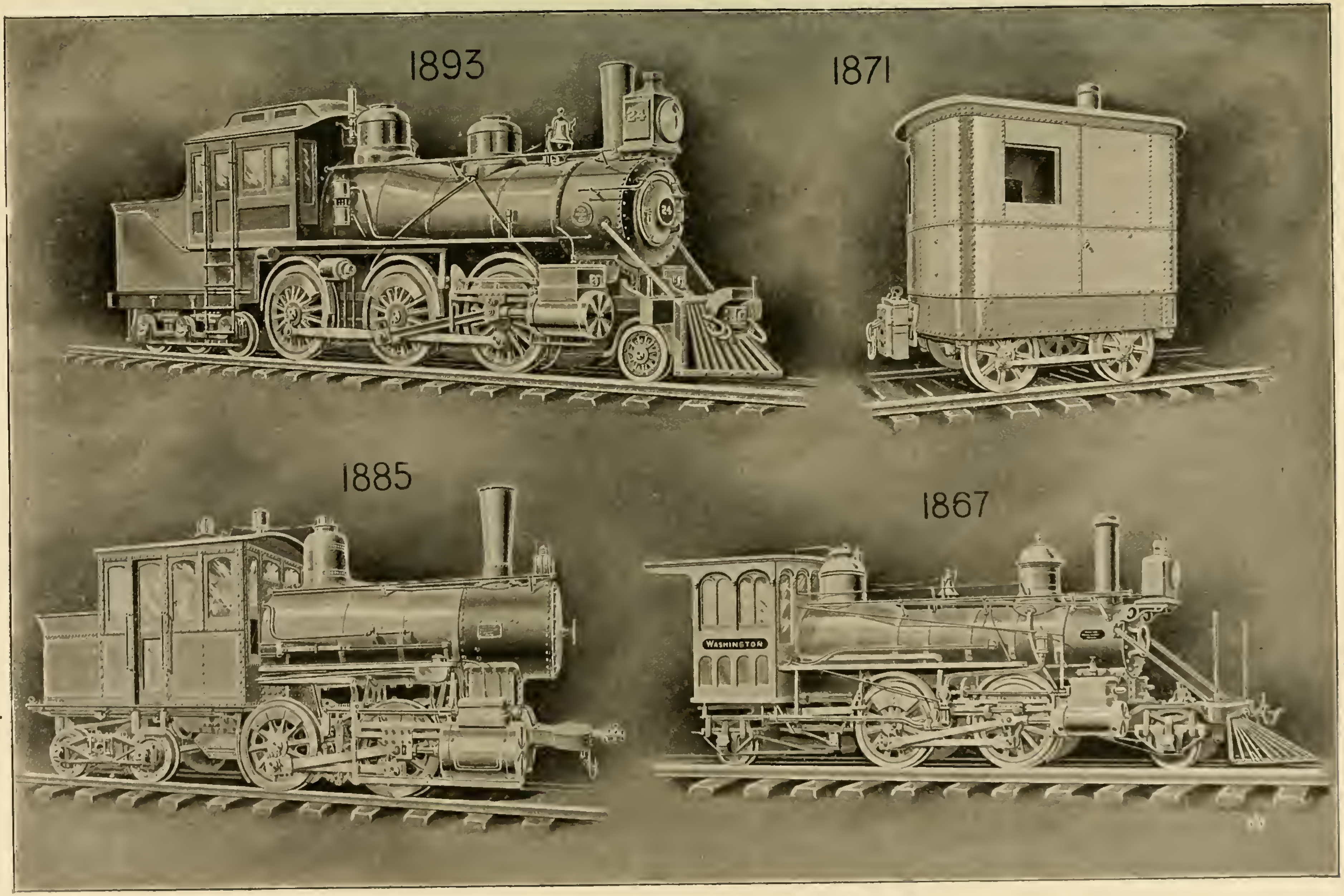
Twenty-Four O'Clock.

If we had our 2-foot rule divided into two parts, had each part numbered from one to twelve, and called the first part A. X. and the last part P. X., we would probably think no more of it than we now do of the double numbering of the hours of the day.

We would probably call a 23-inch ring 11 P. X. inches and imagine it the simplest thing in the world, and call anyone who proposed numbering up to twenty-four and dropping the A. X. and P. X., a first-class crank.

But after we had made a few mistakes, due to getting the A. X. and P. X. mixed, and the boss threatened to fire us for spoiling so much work, we might feel more reconciled toward the crank and want to try the continuous numbering, dropping the A. X. and P. X. by the wayside. This is evidently the case with the railway and postal officials of little Belgium, for they have adopted the 24-hour time system for railway, telegraph and postal work, making two countries which have fallen into line—Italy being the first. It is not compulsory in either country, but is adopted to simplify railway time-tables, and for convenience generally. It clearly does away with mistakes in A. M. and P. M., and is the rational method, which seems likely to be adopted generally when time has rolled around a few more centuries—if not before.

A locomotive engineer, writing from Apizaco, Mexico, says that it is the practice on the Mexican & Vera Cruz Railway to fit up side rod brasses when the rods are at the top or bottom quarter. The breakage of side rods is reported to be very frequent, and several severe accidents to enginemen have happened recently. Our correspondent seems to attribute these accidents to the rods being keyed out of proper length. According to our correspondent, there are a great many shop practices in vogue on that road which ought to be changed.



GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 8.

DEVELOPMENT OF SUBURBAN ENGINES.

1893. Brooks' Suburban.

1885. Forney, for Brooklyn Elevated.

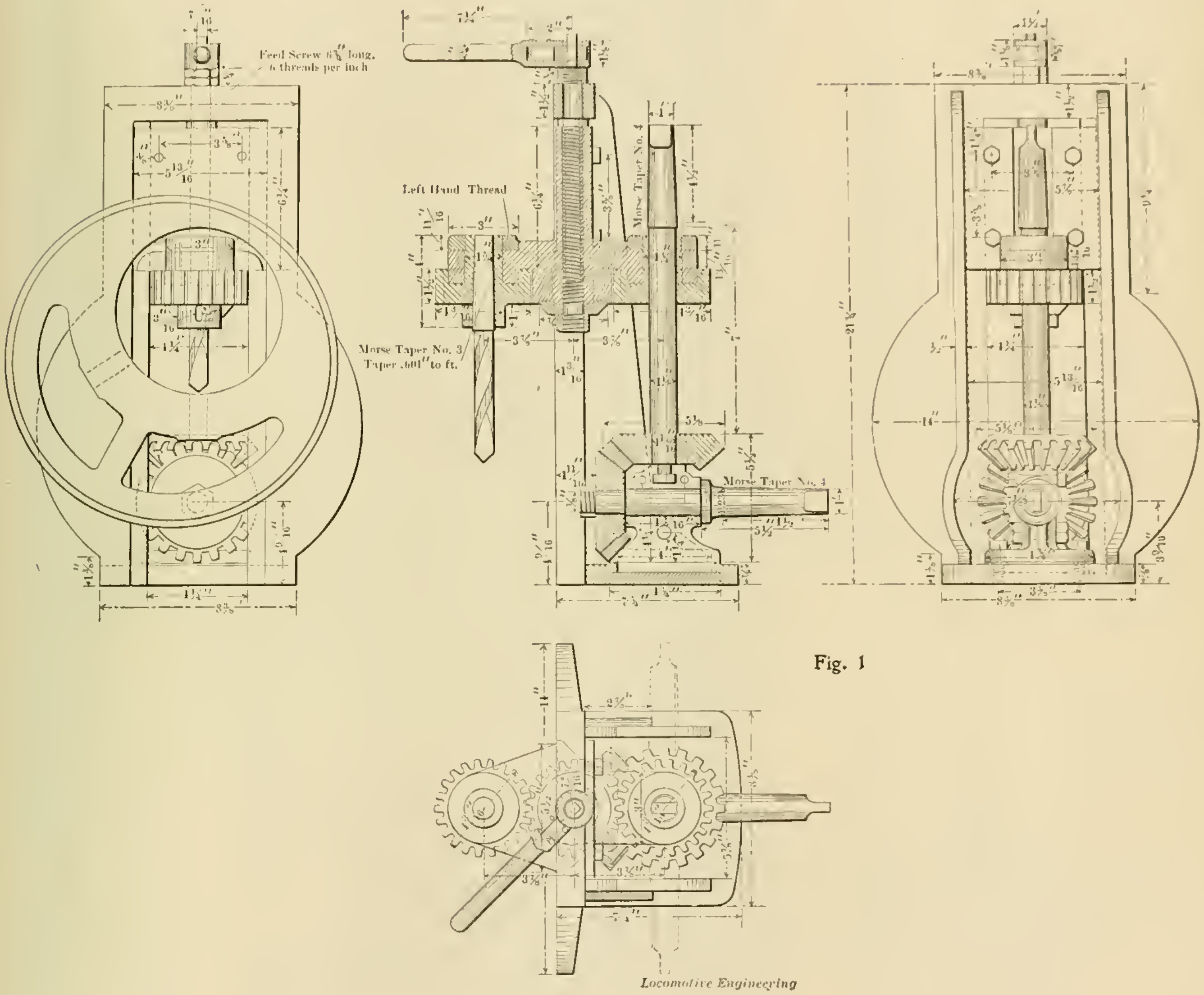
1871. First locomotive for New York Elevated.

1867. Hudson's double-ender.

Special Drilling Machines.

Two very convenient and handy little tools devised by Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville Railroad, are in use in the shops on that line, in the shape of machines for drilling jobs that cannot be well handled at the drill-presses.

In the illustrations, Fig. 1 represents a portable machine for drilling in either a horizontal or vertical plane. The whole thing is contained in a space 18 x 24



SPECIAL DRILLING MACHINES.

inches, and is light in weight for a tool of the kind. It comprises a cast iron frame carrying a sliding head into which is fitted the driving gears. The head is raised and lowered by means of a screw passing through it, which is turned by a ratchet at its top. It is available for use in a drill press, the spindle of which will take the Morse tapered shanks shown on the machine, or the latter may be driven by a flexible shaft or any of the rotary motors so largely in use. One of the jobs it is a necessity on, is shown with the machine, in which set-screw holes are drilled without sacrificing the wearing surface of an eccentric.

Fig. 2 is a drill used for horizontal work only, in direct connection with a drill press spindle from which it is driven by means of the shank secured in the driving gears. The feed is had in this case by the hand wheel shown, the machine being clamped to the drill press table when in operation.

The same drill in all general features as the above is shown in Fig. 3, which has multiplying gears, and is fitted to a base plate that is capable of adjustment to angular positions, thus increasing the range of work of the tool, which is also driven from the spindle of a drill press by the shank, as in the case of Fig. 2.

Still another machine on the same plan of those mentioned is that shown in Fig. 4, which also has the multiplying gears, but is driven by a pulley, thus making it entirely independent of the drill press for power. Above Fig. 4 is shown the base plate carrying the drills shown in the last two figures, the construction showing the slots by which the tool is brought to an angular position with reference to the longitudinal center line of the base. The portable features of these tools make them very popular for a large class of work of the mountain-go-to-Mahomet character.

A band of influential engineers and railway men in Great Britain have organized a National Railway Museum Association, for the purpose of preserving articles that possess historical value in connection with the development of railways. The splendid collection of railway relics now in the possession of the Field Museum in Chicago has exercised considerable influence in stimulating the people interested in British railways to make a systematic effort to preserve the railway antiquities not already destroyed or carried away to other countries. The British government has been applied to for aid in this movement, but like the government of the United States in similar circumstances, refuses to do anything

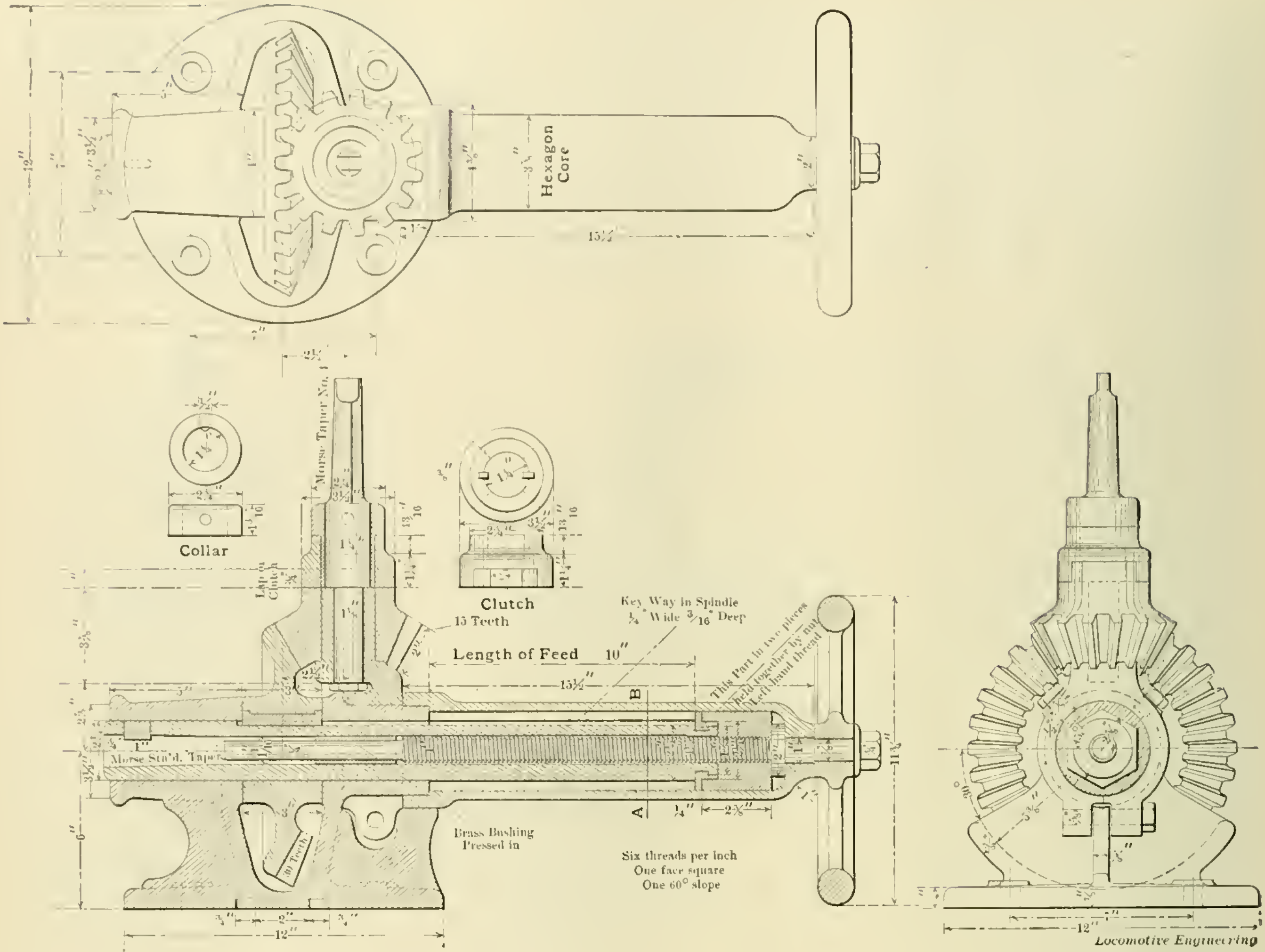


Fig. 2

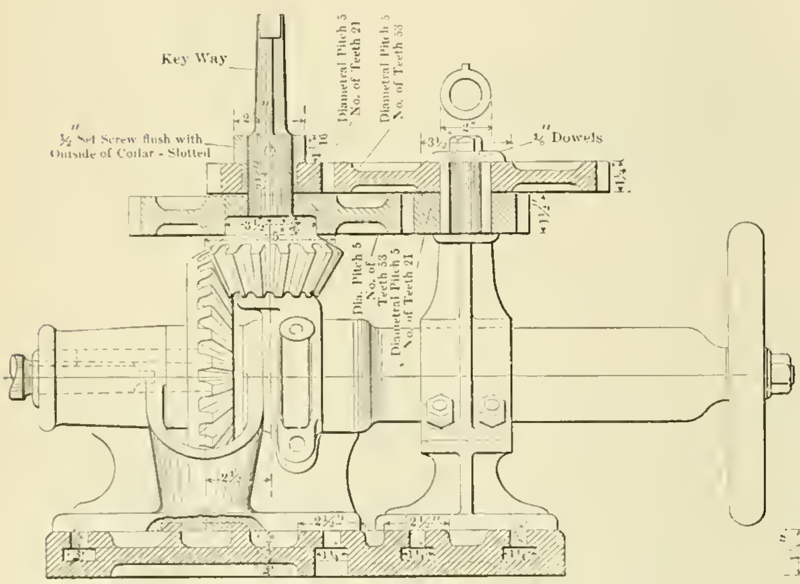


Fig. 3

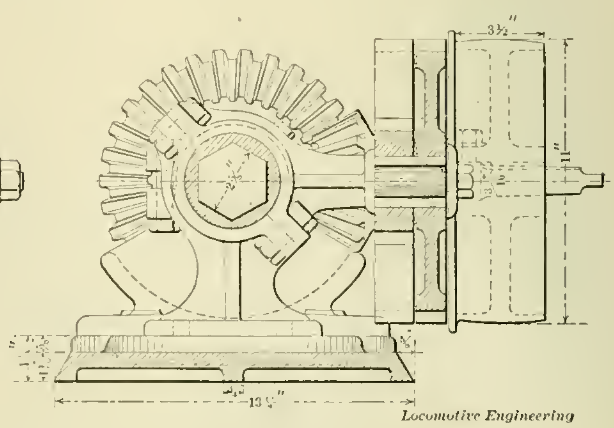
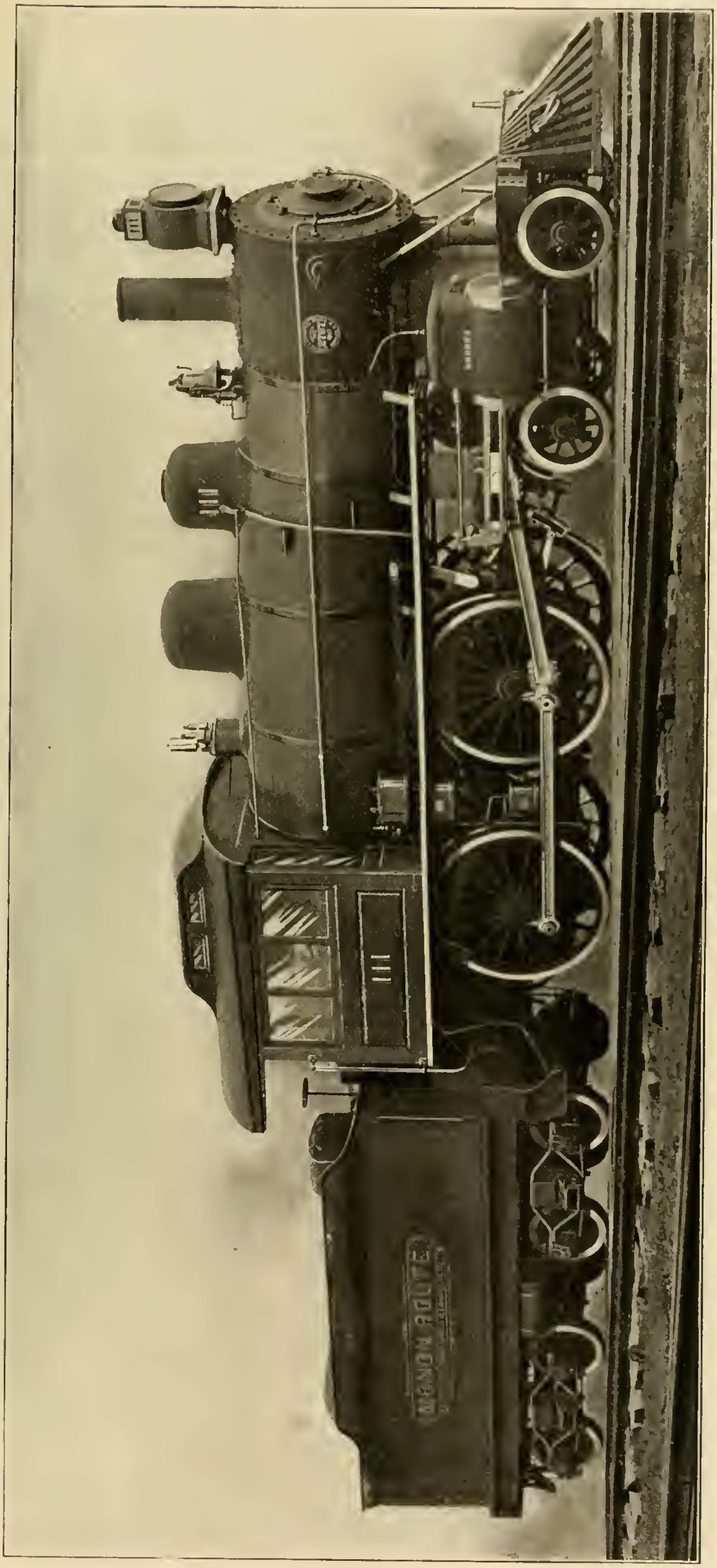


Fig. 4

SPECIAL DRILLING MACHINES.



BROOKS' NEW HIGH-SPEED EIGHT-WHEELER.

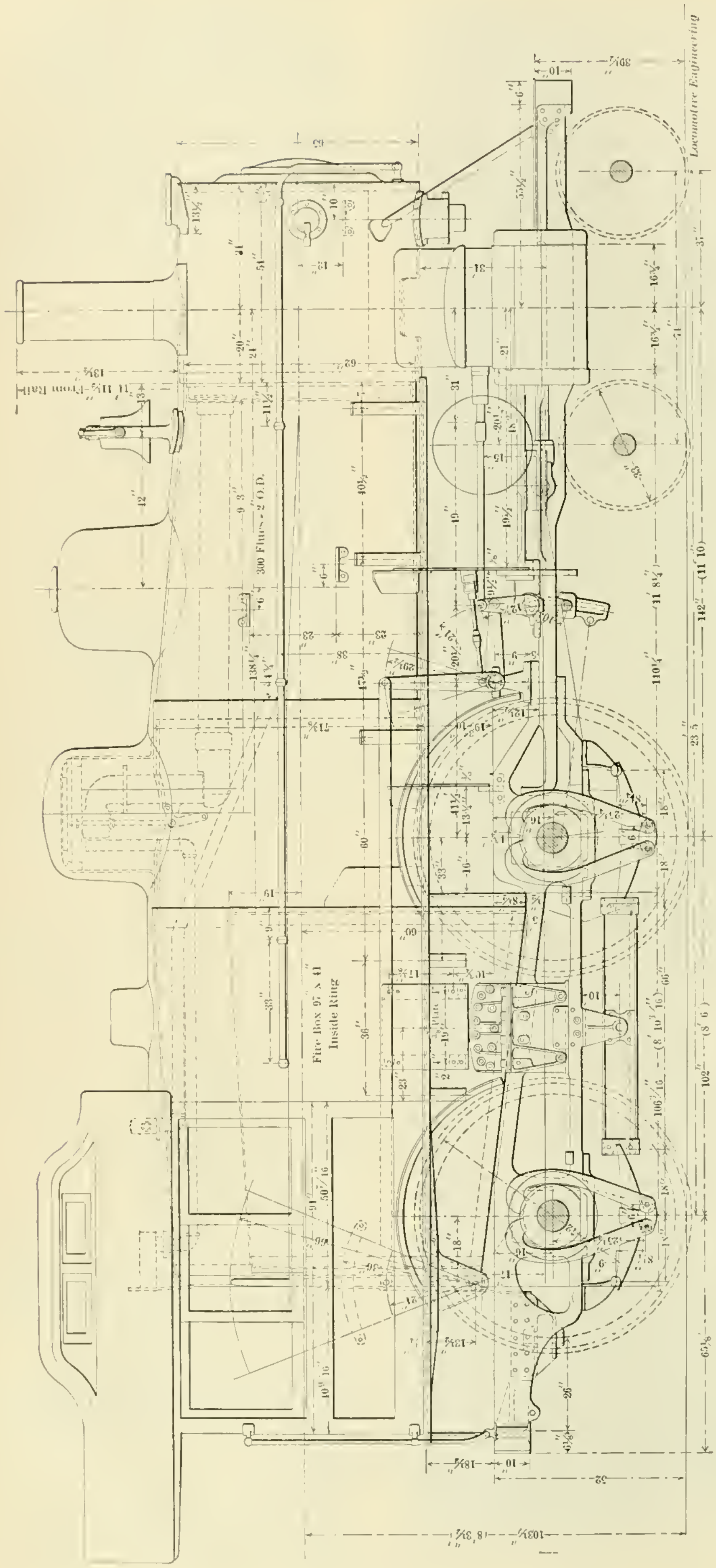
Chicago, Indianapolis & Louisville Eight-Wheeler.

The very handsome eight-wheel locomotive here illustrated by means of one half-tone and three line engravings is one of two recently built by the Brooks Locomotive Works for the Chicago, Indianapolis & Louisville Railway.

The cylinders are 18 x 26 inches, and the driving wheels 72 inches in diameter. The boiler is 62 inches diameter at smallest ring, and is designed to carry working steam pressure of 190 pounds to the square inch.

The following are a few of the leading dimensions of the engine:

Weight on drivers, 79,000 lbs.
Weight on truck wheels, 42,800 lbs.
Weight total, 121,800 lbs.
Weight tender, loaded, 88,000 lbs.
Wheel base, total, of engine, 23 ft. 5 in.
Wheel base, driving, 8 ft. 6 in.
Length over all, total, engine and tender, 58 ft. 1½ in.
Hight center of boiler above rails, 8 ft. 7½ in.
Hight of stack above rails, 14 ft. 11½ in.
Heating surface, firebox, 145.6 sq. ft.
Heating surface, tubes, 1,804.4 sq. ft.
Heating surface, total, 1,950 sq. ft.
Grate area, 26.8 sq. ft.
Drivers, number, 4.
Drivers, diameter, 72 in.
Drivers, material of centers, Pratt & Letchworth cast steel.
Truck wheels, diameter, 33¼ in.
Journals, driving axle, size, 8½ x 11 in.
Journals, truck axle, size, 5½ x 12 in.
Main crank pin, size, 6 x 5½.
Cylinders, diameter, 18 in.
Piston, stroke, 26 in.
Piston rod, diameter, 3½ in.
Kind of piston rod packing, United States.
Main rod, length center to center, 7 ft. 10 in.
Steam ports, length, 17 in.
Steam ports, width, 1¾ in.
Exhaust ports, length, 17 in.
Exhaust ports, width, 3 in.
Bridge, width, 1¾ in.
Valves, kind of, Richardson balance.
Valves, greatest travel, 7 in.
Valves, outside lap, 1⅛ in.
Valves, inside lap, or clearance, 0 in.
Valves, lead in full gear, 0 in.
Boiler, type of, wagon top.
Boiler, working steam pressure, 190 lbs.
Boiler, material in barrel, steel.
Boiler, thickness of material in barrel, ⅝ and 11-16 in.
Boiler, diameter of barrel, 62 in.
Seams, kind of horizontal, quintuple riveted.
Seams, kind of circumferential, double riveted.
Thickness of tube sheets, ⅝ in.
Thickness of crown sheet, ⅜ in.
Crown sheet stayed with radial stays.
Dome, diameter, 30 in.
Firebox, length, 8 ft. 1 in.



BROOKS' NEW HIGH-SPEED EIGHT-WHEELER.

Firebox, width, 3 ft. 5 in.
Firebox, depth front, 79 in.
Firebox, depth back, 62 in.
Firebox material, steel.
Firebox, thickness of sheets, 3/8, 5-16 and 5/8 in.
Firebox water space, width: Front, 4 in.; sides, 4 in.; back, 4 in.
Tubes, number, 300.
Tubes, material, charcoal iron.
Tubes, outside diameter, 2 in.
Tubes, length over sheets, 11 ft. 7½ in.

The engine is equipped with Nathan sight-feed lubricators, Metropolitan injectors, Gollmar bell-ringer, Ashcroft steam gages, United States metallic packing, Cambria axles, Consolidated Company's safety valves and French springs.

The Smoke Question.

In view of the interest now being shown in the question of smoke prevention, the following discussion at the Franklin Institute, Philadelphia, will be of interest.

Mr. Edward Longstreth (formerly of the Baldwin Locomotive Works) said:

"Having been asked if the black smoke coming from locomotives by the use of soft or bituminous coal can be burned, I would say, do not make it, but burn the particles of carbon as soon as they come in contact with the fire. This can be done with a little care on the part of the fireman; he must keep a thin, bright fire, and scatter the coal over the fire as it leaves the shovel and fire often, then very little smoke will be seen.

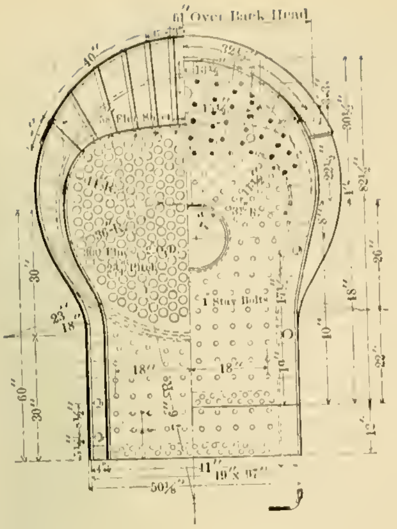
"Thirty years ago, when they changed from burning wood to coal on locomotives, I had a great deal to do with numerous devices patented to consume smoke, but they soon passed out of existence, as it was found the plain fire-box with brick arch and a good fireman showed less smoke than the best patented boilers fired with a bad fireman.

"Watch the trains and you will often see one section not showing smoke, and perhaps with the next section of the same train the locomotive will fill the neighborhood with black smoke, the engines being the same and burning the same coal, but one having a better fireman than the other. In England they fine the engineer and fireman for carelessness if they let an engine smoke.

"The engines are all right (if they tear up a light fire, put in larger exhaust nozzles); educate the fireman and see that he does his duty, then the road will be richer and the neighbors happier."

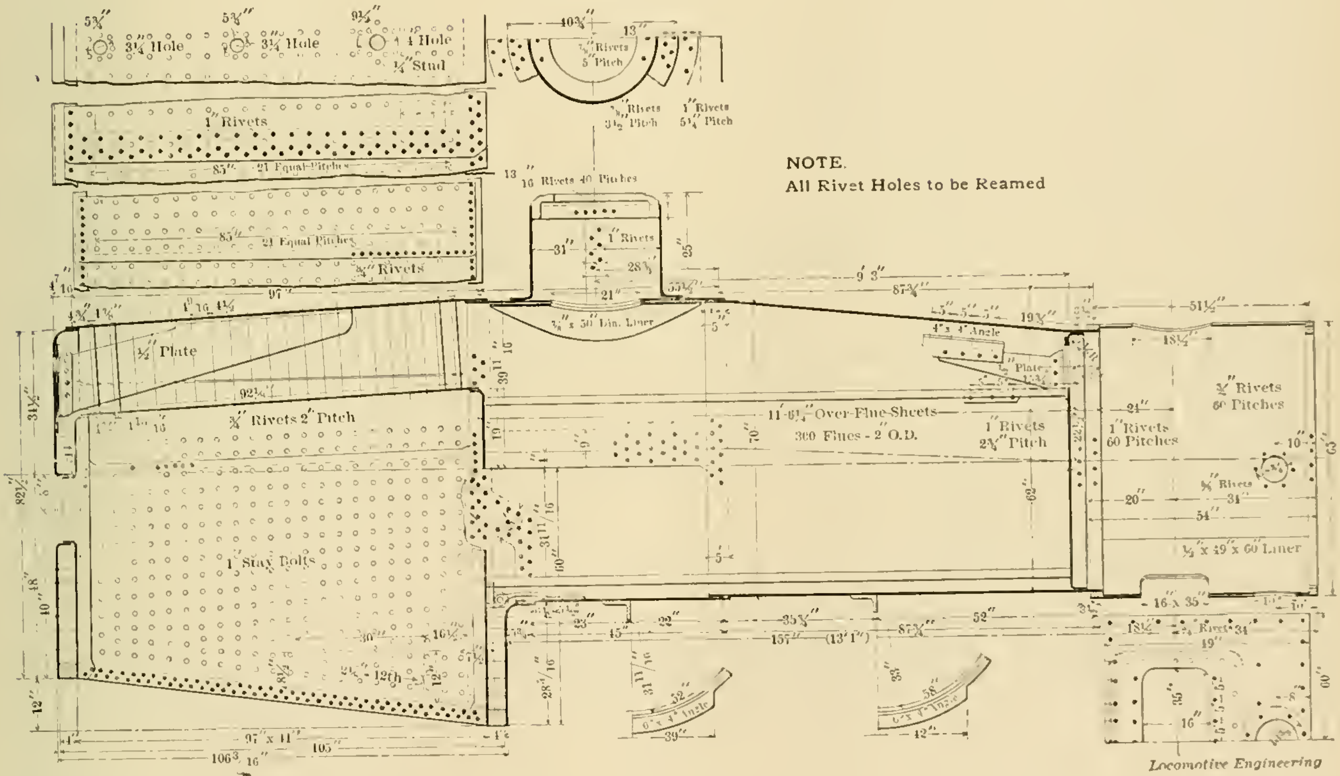
Mr. S. M. Vauclain said:

"It is a very easy matter for one to say that smoke can be prevented by careful firing, and opening of the fire-door, and in various other methods heretofore alluded to. In my opinion, however, the question of satisfactorily avoiding the smoke from locomotives depends upon the amount of coal that it is required of the locomotive to consume per square



NOTE:
All Holes for Plugs and etc., except Gauge Cocks, to be put in in Boiler Shop

Locomotive Engineering



NOTE:
All Holes for Plugs and etc., except Gauge Cocks, to be put in in Boiler Shop

BOILER OF BROOKS' NEW HIGH-SPEED EIGHT-WHEELER.

foot of grate surface every hour. If the locomotive is so constructed that this amount is excessively high, it is impossible to avoid the making of smoke, which occurs from incomplete combustion. Forced firing on a locomotive is not only hard on the fireman himself, but on the bank account as well, as the evaporative efficiency of the fuel is very much reduced. and, consequently, the objectionable emissions from the smoke-stack are very great.

"Of late years, the practice at the Baldwin Locomotive Works, where we design locomotives for burning all grades of fuel, has been to have samples of the coal, which is intended to be burned in the locomotives, submitted to us. We carefully analyze this fuel, and then decide as to the proper dimensions for the fire-box, and provisions for the admission of air over the fire, so as to avoid, as far as possible, the emission of black smoke; or, in other words, to arrive at as near perfect combustion as it is possible for us to do.

"The personal equation, however, on a locomotive, is a somewhat large one. The fact that one locomotive will make no smoke in starting a train out of a station and passing through the suburbs of the town, and that another of the same class and type immediately following, will emit great volumes of black smoke, is sometimes due to the fact that the second engine has been hurriedly called upon to do this service, and the fireman has not had sufficient time, to use a common expression, to "burn a good fire," or, in other words, to get his fire in proper shape before leaving the station. If the fire be in proper condition before he leaves the station, he will have no occasion to put large quantities of fuel in the fire-box until after the city limits have been passed, but if the fire has not been properly prepared, he must get to work at once to furnish his fire with fuel and build it up; otherwise, the fire that he had when he started will be destroyed by the action of the engine, and it will be rendered practically unfit for service, or at least to maintain its schedule speed until he has had an opportunity to recover the fire and get it in good shape. It is, therefore, very easily understood why in some instances a great deal of supposedly unnecessary black smoke is made in starting trains.

"The chief qualification necessary in a locomotive for burning bituminous coal is to have a sufficiently large grate area to give an economical coal consumption per square foot of grate surface per hour."

Regarding the use of petroleum for fuel, the conclusions of Dr. Dudley in 1888 still holds good, despite the discovery of new oil fields in this country. The Pennsylvania system alone, would, roughly speaking, consume about one-third of the entire oil production of the country.

The Baldwin Locomotive Works report a decided improvement in orders since the month of May, that month being the lightest in fifteen years. It begins to look as though better business was at last coming into view.

Practical Letters from Practical Men.

Inside Clearance versus Lengthening Eccentric Rods.

Editors:

It has been found that while we have little difficulty in setting a valve so that it will cut-off square, at the same time, the sounding of the exhaust would indicate that the valves were still "lame." This is due, as is well known, to the angularity of the connecting rod; in other words, to the fact that, with a uniform release in the cylinders, the rotation of the driving wheel from the front dead-center to the release, going backward, would be less than from the back dead-center, going forward, and to obtain equal periods of exhaust, with a uniform rotation of the wheel, it becomes necessary to lengthen out the eccentric rods about 5-64 inch, after the valves have been set with some determined equal lead at full gear. It is well known that if the valve has no inside lap or inside clearance, the points of release and compression are coincident, and as it is desired to cause the release to occur earlier at the back center, and later at the front center, the eccentric rods are lengthened, which causes the valves to sound square. This manipulation of the eccentric rods, however, results in an increased lead at the front center, and it is correspondingly decreased at the back center, and as it is desirable to have the valve possess equal lead at both centers, instead of lengthening the eccentric rods a determined amount, the valve is cut out at the back edge of the exhaust cavity which, on our road, we have found that 1/8 inch is about right. As regards negative lead, I have set the valve on some engines with as much as 1/8 inch negative lead in full back gear, that is, after setting them with 1-16 inch positive lead for both motions, the back-up eccentrics were moved from the crank to show 1/8 inch negative lead, and in doing this the lead is reduced in the running cut-off for forward gear. On some engines we have obtained a fairly constant lead for three or four notches, after the lever has been hooked up; the cut-off, of course, changing with the change of lever. The accompanying indicator cards were taken from an engine having 1 1/8 inches outside lap, travel of valve 6 inches, 3-16 inch inside clearance at back edge of valve. The valves were set "line and line" for both motions. Card No. 1 was taken just as the engine was starting, or rather after it had made about twelve revolutions, and the effect of this inside clearance is very apparent from the change in the direction of the compression curves at *B*, which is caused by steam blowing over from one end of the cylinder to the other, as, at this point in the stroke, the two ends are in communication with each other. This inside clearance also causes a later or lower compression curve at the back end of the cylinder which is clearly shown by cards No. 2 and No. 3. This blowing over, however, is only seen in cards taken at very slow speeds. If, instead of cutting out the back edge of the valves, the eccentric rods had been lengthened to obtain equal periods of exhaust, the cards would have shown a late steam admission at the back center, and an early one at the front center, and it will be readily seen that the leads will remain equal at both centers by giving the valves inside clearance. It will be noticed that the M. E. P. and consequently the I. H. P., is greater for the front end of cylinder, which was equalized later on by slightly shortening the forward motion eccentric rods, as they were not quite square at the first indication of the engine. The valves on this engine were finally changed and set 1-16 inch positive lead, at full forward gear, and 3-32 inch negative lead, at full backward gear, and much better results were obtained. If, by indicating an engine, it is found that the compressions are too high, the front edge of the valve can be cut out a determined amount, and the back edge a corresponding amount, so as to keep the sound of the valve square. It is important to keep a record of all engines having valves with inside clearances, so that the valve-setter will set the valve with equal leads determined upon for both motions, and run over the cut-off for correct length of lift link hangers only, that is, to make the sum of the cut-offs equal for both sides.

[Scale, 100; boiler pressure, 180.]

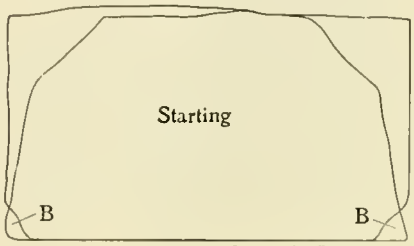


Fig. 1

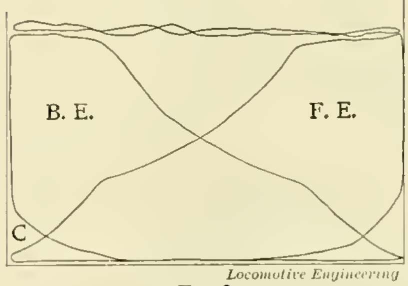


Fig. 2

	B. E.	F. E.
Area	2.34	2.38
M. E. P.	83.9	85.3
I. H. P.	124	128

Revolutions, 88.

B. P. 175

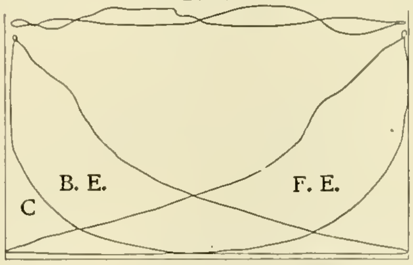


Fig. 3

	B. E.	F. E.
Area	1.16	1.28
M. E. P.	41.7	45.7
I. H. P.	159	179

Revolutions, 228.

EFFECT OF INSIDE VALVE CLEARANCE.

S. J. DILLON.

Jersey City, N. J.

Compression and Clearance in Steam Engines.

Editors:

Rankin, it is said, has demonstrated, in theory that is difficult to refute, that the losses incident to large clearance in steam engines may be recovered, or prevented, by a proper adjustment of the compression. I am not at all familiar with that writer's work, but presume that this contention is based on the commonly accepted theory, that cylinder condensation is caused by the cooling effect of the exhaust on the cylinder walls, and that an initial temperature, approximating that of the entering steam, may be restored to them by compression, without, or partially without, cost.

The enormous heat-absorbing capacity of aqueous vapor, with which the clearances are filled by compression, is well known; but, still, engineers of high and low degree will persist in associating condensation losses with the absurd fallacy, that the temperature of the iron walls of the cylinder can be made to dance in harmony with the strokes of the piston, whether they are at the rate of 100 or 600 to the minute. Iron that receives a hot-water bath once in every alternate fraction of a second will never reach a temperature much higher than that of the water, whatever may be the temperature of the steam applied in the intervals. If the cylinder walls could be kept dry, they would readily attain a high temperature; but under the best conditions possible, in any engine as yet publicly known, the entering steam is chilled not only by the comparatively cold cylinder walls, but has to mix throughout the entire clearance spaces, with the water-laden products of compression.

With small clearance, the temperature may be made to rise very rapidly near the end of the stroke, and with a proportionately small volume of vapor compressed; but with large clearance the compression must begin earlier to establish the same temperature, and therefore a much greater volume of water is swept into the clearance spaces by the piston. It is therefore quite conceivable that the difference between 3 and 6 inches of compression may mean all the difference between a good and a bad engine, provided a corresponding difference exists between the capacities of their clearance spaces. If the compression is low and the clearance large, the pernicious cause of initial condensation still remains in the low temperature of these partially filled spaces.

When compression begins, the heat units confined in the space before the piston are just as incapable of performing work, under the conditions then prevailing, as if they had been disseminated into the polar regions. To drive them into the clearance spaces, means to expend considerable more energy than they can possibly return in the next stroke of the piston, in accordance with the universal law of work. It is simply an exchange of the effective pressure on the piston, for so much compressed vapor, with all the losses incident to the transaction, on the wrong side of the account. These losses, if the clearances are large and the compression high, may be offset to a certain extent by reduced initial condensation: but it is difficult to believe that a big dose of hot water could cure such a disease, when a small one has a contrary effect. The available material for filling the clearance spaces by compression is bad, and the choice between leaving them empty or filling them with such material, is equally bad. The best remedy is, to leave as little room for either alternative as possible.

W. F. Cleveland.

Moncton, N. B.

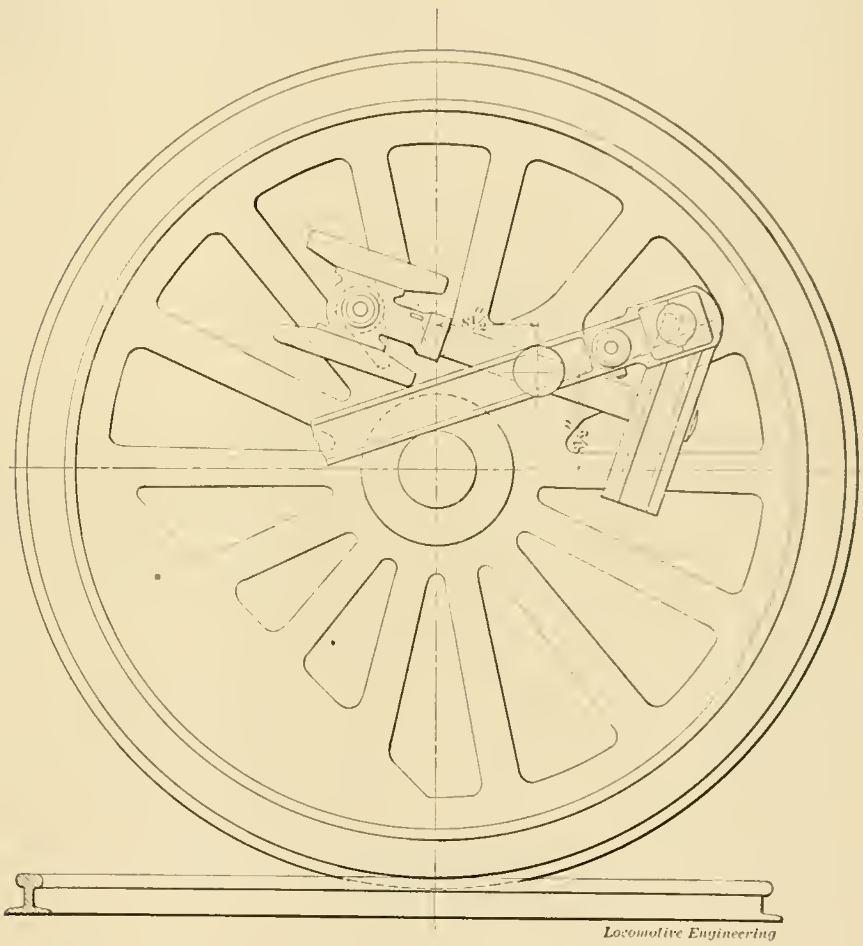
The Action of Inertia and Steam Forces Combined.

Editors:

If we consider the reciprocating parts of an engine located on the crank pin as in Fig. 1, their inertia (when in regular service) may be calculated closely enough for many practical purposes by treating them as a revolving weight, when their inertia will be the same as the horizontal component of the centrifugal force of a like weight.

To illustrate: Take an engine with 19 x 24-inch cylinders, 72-inch wheels making 300 turns per minute, the steam pressure and distribution as shown by the cards in the upper part of Fig. 2. The unbalanced weight of the reciprocating parts to be 200 pounds, which, at the speed as stated, is equal to 6,000 pounds. From these data, both the steam and inertia forces have been plotted in the lower part of Fig. 2. The large circle represents the path of the crank pin, and is drawn to a scale of 1½ inches to the foot. The small circles drawn in the circumference of the large one represent the crank pin at various points of the stroke, and are numbered from 0 (the forward center) to 19. From these points horizontal lines are drawn, and represent the inertia of the reciprocating parts. That is, the horizontal distance from any point to the vertical center line represents the inertia of the reciprocating parts when a radius line represents the centrifugal force of a like unbalanced weight. In this case the to which they are connected by vertical dotted lines. The cards are intended to be alike, so the figure on one will represent the same ordinates on the other. The vertical scale to be used on the cards is 100 pounds to the inch. In order to make the inertia and steam force more readily comparable, the steam forces have been reduced to tractive force, and also to the same scale as the inertia forces.

The tractive force has been determined by multiplying the force on the crank-pin, due to the steam pressure on the piston, by the vertical distance that the crank-pin is above or below the center of the axle, and dividing the product by



ACTION OF INERTIA AND STEAM FORCES.

radius line is 1½ inches long, and as the centrifugal force is 6,000 pounds, it is clear that the scale by which these lines are to be measured will be 4,000 pounds per inch. As the inertia force in the four quarters has been assumed to be equal, only the first quarter will be measured and marked. Beginning at point 1, we find its length to the horizontal line to correspond to 5,750 pounds; point 2 line, 4,900; point 3 line, 3,500; point 4 line, 1,900. At point 5 the engine is on the quarter and no inertia force exists.

Referring to the indicator cards, it will be seen that their ordinates are drawn to correspond with the points in the stroke the radius of the wheel; the quotient is the tractive force. In making these calculations for the various points in the stroke, it must be kept in mind that the total steam pressure on the piston does not reach the crank-pin at all points. For instance, at point 1 it will require 5,750 pounds of the steam pressure on the piston to make it and its other reciprocating parts keep up with the crank-pin, and it is largely this disparity between crank-pin and cylinder-head pressures that causes an engine to do the "nosing" act. With steam distribution as shown in the cards, nosing will be increased by the tractive force, as will be seen further on.

Beginning with the engine on the center at point 0, we have an inertia force of 6,000 pounds ahead and no tractive force.

At point 1 the tractive force is

$$\frac{284 \times 150 - 5750}{36} \times 3.75 = 3,840 \text{ pounds.}$$

At point 2 the tractive force is

$$\frac{284 \times 137 - 4900}{36} \times 7.1 = 6,707 \text{ pounds.}$$

At point 3 the tractive force is

$$\frac{284 \times 110 - 3500}{36} \times 9.68 = 7,459 \text{ pounds.}$$

At point 4 the tractive force is

$$\frac{284 \times 81 - 1900}{36} \times 11.25 = 6,595 \text{ pounds.}$$

At point 5 the tractive force is

$$\frac{284 \times 56}{36} \times 12. = 5,300 \text{ pounds.}$$

down in Fig. 2, and do not need any explanation till we come to point 6, where the inertia force is subtracted from the tractive, leaving only 1,100 pounds that is effective in propelling the engine ahead, hence the line from point 6 is run 1,100 ahead of the vertical center line. At point 7 the traction is but 450 pounds, and is subtracted from the inertia force as shown by the reference line just above and to the right of point 7. At points 8 and 9 the pressure is on the back side of the piston, and therefore the tractive force is negative and must be added to the inertia, as shown at these points on the diagram. This completes the back stroke. The forward stroke will be just as efficient in propelling the train, but it has a very different appearance when laid off on the diagram.

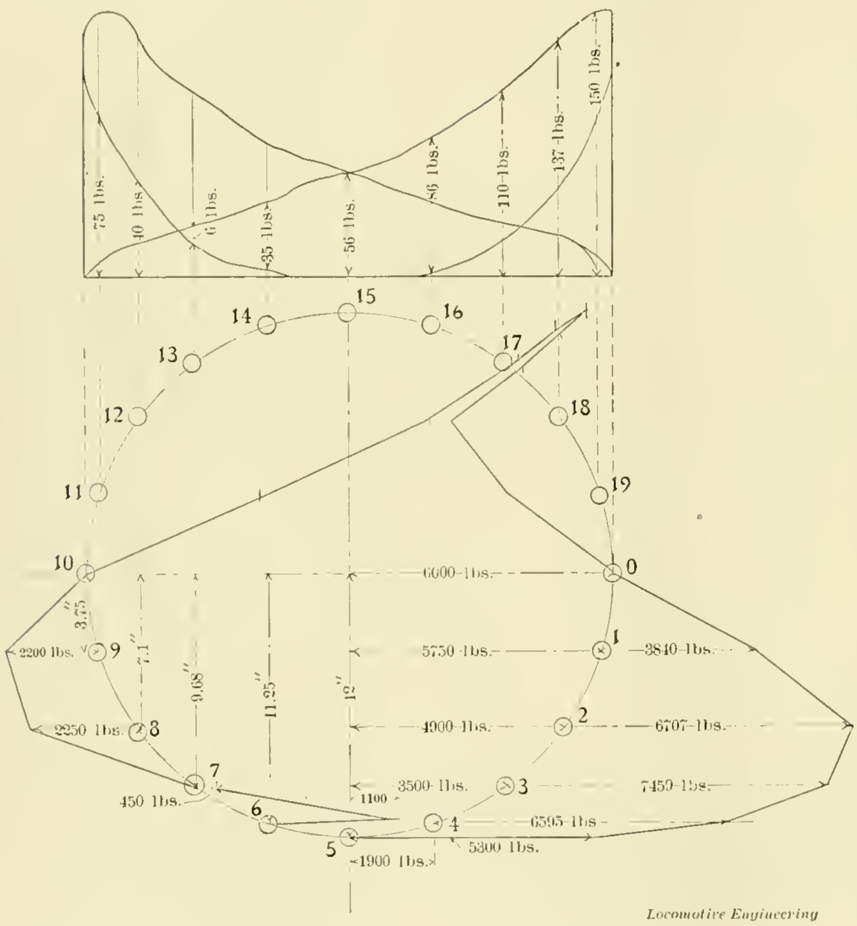


Fig. 2

ACTION OF INERTIA AND STEAM FORCES.

At point 6 the tractive force is

$$\frac{284 \times 35}{36} \times 11.25 - 1,900 = 1,100 \text{ pounds.}$$

At point 7 the tractive force is

$$\frac{284 \times 6}{36} \times 9.68 = 450 \text{ pounds.}$$

At point 8 the tractive force is

$$\frac{284 \times 40}{36} \times 7.1 = 2\ 250 \text{ pounds.}$$

At point 9 the tractive force is

$$\frac{284 \times 75}{36} \times 3.75 = 2,250 \text{ pounds.}$$

The above values have all been laid

This is caused by the fact that in the first quarter (from zero to point 5) the tractive and inertia forces both act in the same direction. In the second they are mixed, part of the time the tractive is one way, then the other. In the third they are opposite, while in the fourth they are both ahead till the tractive becomes negative.

In tracing the second stroke point 11 corresponds to point 1 in the first, and the same distances are laid off all the way around in the second stroke as they are in the first, remembering always to give the same distance to opposite points.

So far we have dealt only with one engine. It will now be assumed that the wheels are set quartering, but are loose on the axles; that the right-hand engine is at point zero, and that the left-hand engine (which in all other respects is identical with the right) is at point 15. In this position the forces ahead are nearly the same on each side. A greater inequality between the two sides will be when the left side is at point 18, where it has 2,650 pounds inertia ahead, while the right side has at point 3, 3,500 inertia and 7,459 pounds tractive, both ahead, say a total of 11,000 pounds. This leaves a difference of about 8,000 pounds in favor of the engine nosing to the left. With the right at point 5 and the left at point 0 the forces are evened up again. With the left at point 3 there is a continual inertia and tractive of 11,000 pounds ahead, and the right at point 8, with a combined inertia and tractive, both back, we have a sum of about 18,000 pounds which ought to induce the engine to nose to the right. Of course, somewhere in the revolution an equal amount of nosing to the left ought to take place, but I will leave it for the reader to determine.

The object in assuming the wheels to be loose on the axle has been to allow the two forces (inertia and tractive) to act together, when an opportunity offered, to the fullest extent. If the wheels and axles were non-elastic, and were rigidly fastened to each other, then the inertia force alone could produce nosing, and not then, without slipping the wheels on the track on one side or the other. But there are no non-elastic materials, and from the amount of spring that I have seen in axles when turning the drivers, I am satisfied that the axle will readily twist enough when the steam pressure is maximum on the crank-piece on one side and nothing on the other, to very perceptibly increase the nosing disturbance.

J. H. DUNBAR.

Youngstown, O.

Narrow Escapes.

Editors:

I wish to claim exemption from the rule as set forth in "Fatal Accidents," on page 429, June number, in which it is claimed that "no engineer ever came out alive from his third disaster," and claims that the man who has had two close calls will abandon railroading if he is wise. I think I have been as near death's door, as an engineer in railroad disasters, as anyone could be, and not enter in.

In one instance a bridge over Pleasant Run Creek, within one mile of Indianapolis, dropped from under my feet while the drivers of the engine were still on it. The engine carried the fireman and myself over, the tender went down, turned end for end and bottom up, with a brakeman on it. The fuel was all thrown out, the brakeman thrown into the fuel pit, and thirteen cars on top of it; and yet that brakeman was not seriously injured. The whole fall was over twenty feet and occurred at night.

In another instance, with this same engine, we ran over a horse on a trestle. The engine fell fourteen feet, turned bottom up and rested against the trestle. The fireman and myself were thrown more than thirty feet to one side of the wreck and landed on the roof of the cab, which was torn loose and landed bottom side up. The brakeman was landed some distance back of us. He had one of his fingers broken; the fireman was badly scalded on one leg from the back of the knee joint down to the heel; I was considerably bruised, but was able to help carry the fireman half a mile to a hotel. This was at night.

In another instance I was running the fast night train (passenger) fifty minutes late, and bound to make up a certain number of minutes. It was a very foggy night. An extra freight train was stalled half way up the grade and no light out, while we were within fifty feet of it. The tender was full of wood. It was on an embankment where the willows had just been cut down and the stumps stood up like heckle teeth, so that it was death to jump.

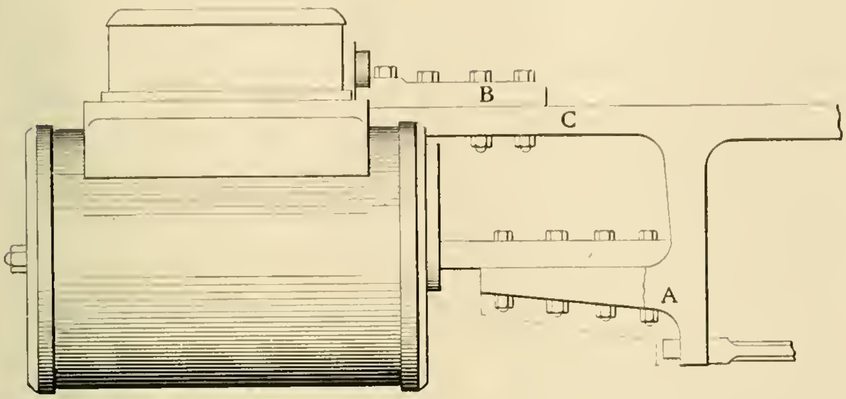


Fig. 1 *Locomotive Engineering*

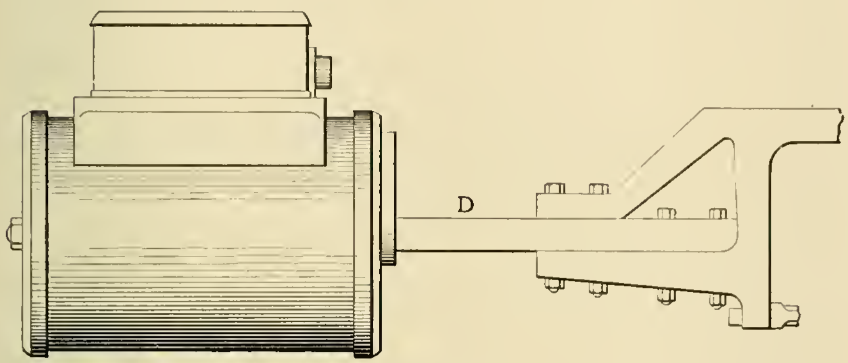


Fig. 2 *Locomotive Engineering*

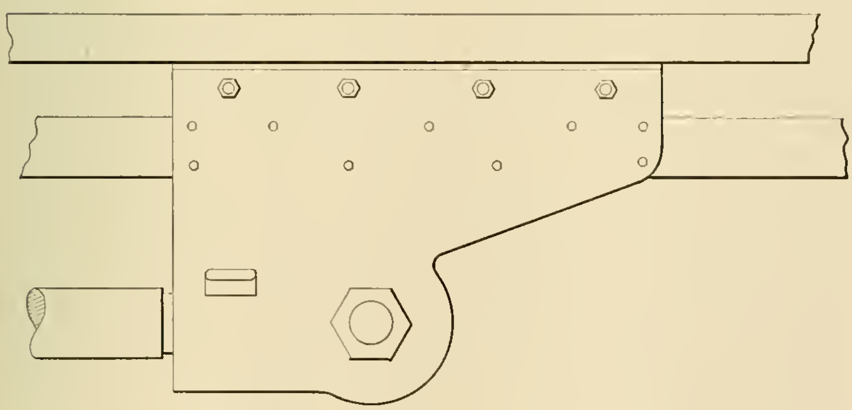


Fig. 3 *Locomotive Engineering*

UNBALANCED CONSTRUCTION.

The fireman got up on the wheel cover on his side; I got on the outer edge of the gangway; the tender was driven under the footboard and the wood slid into and completely filled the space clear above the fire door, and neither of us was hurt. This also occurred in the night.

The conductor of the freight train was new, and on his first trip, and forgot that there was any regular passenger train on the road. It was also his last trip on that road. I run some years after that, but finally quit engineering. This all occurred on the J. M. & I. Ry., between Indianapolis and Louisville. Since then I was in a coach that turned over and I received very slight injuries. These all seemed to be very serious disasters at the time, and I think I have a right to claim exemption from the rule referred to.

BENJ. W. SMITH.

Princeton, Ind.

Unbalanced Construction.

Editors:

The value of symmetry in machine building is often neglected. Mere adjustment of parts for the benefit of the eye is not meant, but the balancing of those parts which are affected by the strains due to the work imposed upon them.

A case in point is the experience of a certain railway company with a class of locomotives built by a well-known firm, as compared with that of a connecting line, which uses the same make of engines with some changes in design.

The locomotives of the first mentioned road have frames of the construction shown in Fig. 1, the particular part which is shown being that between cylinder and front jaw. It will be noticed that the lower section is in the same horizontal plane as center of cylinder, and that the upper section is above center line about 14 inches.

A vast amount of trouble has been experienced by the breaking of frames at the point *A* through the bolt hole; some breaking so often that instead of welding break together, huge patches are put on, as shown by dotted lines.

After two or three fractures in the lower section, a break generally occurs in the upper one at *C*.

Fig. 2 shows the design adopted by the second mentioned road, and which gives practically no trouble at all; a broken frame being almost unknown.

In the first case, the constant extension and compression of the lower part, due to action of piston being greater than that of the upper section, as it carries by far the greater part of the load, causes a bending action. This results in fatigue and crystallization, which centralizes in *A*, causing fracture. The same action follows in the upper part, but more slowly.

The design of Fig. 2, which does not contain at *D* the aggregate amount of metal contained in the two sections of

Fig. 1, and which gives the best results, proves that the addition of the upper binder is a source of weakness instead of strength, as it destroys the symmetry of construction.

Another case is that of the form of crosshead shown in Fig. 3. These crossheads are believed to be one cause of a large number of broken piston rods. The amount of unbalanced metal above center of crosshead pin weighs about 150 pounds. It does not require a mathematical demonstration to see that a tremendous bending moment is brought on the neck of piston rod by the constant reversal of movement due to reciprocation. The guides do not offer much resistance to it when they are worn apart from 1-16 to ⅛ inch, as often occurs.

In ordinary freight service at speeds of 15 to 20 miles per hour, the bending action is imperceptible; but when a 35 to 40 mile rate is attained, the final result is disastrous.

FRED E. ROGERS.

Corning, N. Y.

The Baltimore & Ohio Locomotives.

The fifteen freight locomotives recently ordered by the receivers of the Baltimore & Ohio Railroad from the Pittsburg Locomotive Works, will be similar in design to those furnished by the same company earlier in the year. They will not be quite as heavy, as they are to be used on what is known as the Second Division, where the grades are not as bad as on some other parts of the road.

They will have simple cylinders 21 x 26 inches, with 50-inch driving wheels, and a total wheel base of 23 feet 2 inches. The firebox will be located on top of the frames, with inside dimensions of 42 x 116 inches, and a grate area of 33.83 square feet. The boilers, built for 180 pounds pressure, will be of the extended wagon top type with a 60-inch waist diameter and a total heating surface of 1,964.5 square feet, with a firebox heating surface of 173.73 square feet. These engines will have frames specially braced and will use a cast-iron deck plate filling in between the frames ahead of cylinders and back of bumper brace, to prevent the racking strain which is usually concentrated on the cylinder saddles.

The Baldwin Works have begun the delivery of the engines ordered from them sometime ago, a dozen of them being in actual service.

How Not to Make Heavy Repairs on Locomotive Boilers.

BY HENRY J. RAPS.

In this age of invention a large number of tools have been made to facilitate the construction and repair of the locomotive boiler, and the all-important question with both builder and repairer is—how to do the work as quickly and cheaply as is consistent with safety, good construction and permanency of repairs. For the builder this is a very proper question, and also for the repairer, when repairs are necessary; but there is a question of still greater importance to the repairer, and that is—How not to make repairs, or, to modify it, how to avoid making extensive or heavy repairs.

To illustrate this, we will go back to the new boiler. It has been in service for two or three months; has had the best of care; has been washed regularly every 500 or 600 miles—more or less—as circumstances and the condition of water demanded; has been inspected regularly; while the scale has been getting thicker all over the inside of the boiler, you have noticed no unusual accumulation; yet the boiler-maker comes to you and reports three or four stay-bolts leaking, or possibly only one. You begin to think there is nothing in washing out after all—it's a laborious, dirty job all the way through, and unsatisfactory in the end. You try to study out the cause of the bolts leaking. Are the stay-bolts spaced too far apart? Were they put in too tight or too loose? Were they hammered too much or too little? Are the heads too large or too small? Was the thread partly stripped in putting in the stay-bolts? Is it on account of poor material in the bolts or is it poor material in the sheet, and has a crack developed on account of it? Is it on account of bad water? Has the blower been used too much on the road or on the clinker pit? Were the dampers left open after fire was drawn? Was the furnace door opened on the road to check the fire?

These or other possible reasons may be assigned by you as the cause of the bolts leaking. You are wrong in each case. If any of these reasons could be assigned as the cause of the bolts leaking, why are not more leaking? But, you argue, poor workmanship or a stripped thread may be the cause. You forget the engine has been in service two or three months, and if this was the cause the bolts would have leaked before this. Well, you say, bad water will cause the bolts to leak. That it true; but never a few in one locality. All the bolts below swell will leak more or less, and if the water is very bad, all the bolts in the firebox will leak; and not only the bolts, but the tubes and crown-bar rivets as well. But now you have it—it must be on account of the misuse of the blower, or dampers left open after fire was drawn. Wrong again. The misuse of blower and damper will cause bolts to leak, especially in the lower part of box; but never a few in one locality.

Well, you say, no matter what the cause, it is plain the bolts are leaking, and you will have them caulked, and that will end the trouble. Let us follow the matter up and see. The bolts are caulked and remain tight for several trips, and you congratulate yourself on having applied the proper remedy and curing the case, even though you did not diagnose it correctly. But here comes the boiler-maker; he looks very sad, and approaches you slowly. He appears to have bad news, and probably wishes to break it gently. It's the same story you have heard before—stay-bolts leaking in the new boiler—same bolts that leaked before, and possibly you get angry and say: "Just what I expected." Locomotive builders don't build engines like they used to; the engines of to-day are much inferior to those built years ago. The boilers are too heavy for the frames, and therefore an extraordinary amount of strain is thrown upon the boiler. Or, you say, what else can you expect? Competition is so keen between builders, that they are obliged to throw the work together in order to make any profit out of it, and it's a wonder the boiler has done as well as it has. It's not your fault, anyway, for you have done the best you could—had it washed out regularly and thoroughly, and inspected properly, and you are sure nothing more can be done.

You order the boiler-maker to caulk the bolts again, and keep them caulked. You never want to hear of them leaking again. Ready to do your bidding, he caulks them and does not trouble you any more. The boiler is doing fairly well. There is an occasional report on the work-book of stay-bolts, crown-bar rivets and tubes leaking; but they do not trouble you, as they are a common occurrence.

The engine has been in service for ten or twelve months, and the tires are to be turned. It is necessary to take down pan and grates, and you conclude this is a good time to inspect the firebox. And what a sight it is! Instead of three or four stay-bolts leaking, there are from fifty to seventy-five on either side, and from fifteen to twenty small cracks have developed on either side; a half-dozen stay-bolts have the head and thread nearly stripped; thirty to forty crown-bar rivets leaking; the crown and sides are bulged, and the tube-sheet is nearly as bad. There are a few cracks in the door ring, and altogether the firebox is in a sad plight.

You hold up your hands in horror, and exclaim: Just what I expected. It's a poor grade of steel; manufacturers of steel have worked up a good reputation and are selling a low grade of steel on a high-grade reputation. Or, if the boiler has been using bad water, the water is blamed. You never saw such bad water; it is ruining all the boilers; it pits the tubes and shell; it grooves the bottom of shell next to the seams; it grooves both the inner and outer sheets of water-leg next to mud-ring; it causes the firebox sheets to bulge and crack, frequently bulging away from the stay-bolts and crown-bar rivets or radial stays; it causes tubes to collapse, and, through the repeated stretching of tubes beyond their elastic limit, causes the front tube-sheet to bulge, and on account of this bulging, the tube-sheet develops a crack around the bottom at the bend. But the boiler must be put in good condition again. Possibly you have new half side-sheets put in the firebox, a patch put on the door ring, tubes taken out, safe-ended and reset, and the crown-bar rivets caulked.

And now you know you have put the boiler in the best possible condition, and will have no more trouble with it. But in two or three weeks the crown leaks as bad as ever, and grows gradually worse. Cracks develop; the sheet bulges worse than before. In two or three months the stay-bolts begin leaking—two or three to begin with—and grow gradually worse, and at the end of the second year the boiler needs a new firebox. The bad water is blamed again; or, if the firebox is long and shallow, it comes in for its share of the blame.

Let us see what there is in the bad water. It is a well-known fact that in some localities it is impossible to keep tubes and stay-bolts tight for any reasonable length of time, but this trouble is only local. In general the greatest trouble experienced is from incrusting matter, the principal one being carbonate of lime, which is held in solution by free carbonic acid. As the water evaporates, the acid is released and the carbonate is precipitated, forming scale. When the scale becomes thick enough between the stay-bolts, crown-bar rivets or tubes to make trouble, its presence is shown by particles of coal burned on the sheet; as the scale becomes thicker the water is removed farther and farther away from the sheet. The result is, the sheet becomes so hot that it loses its strength and is forced out by the pressure upon it; the scale is loosened slightly, allowing the water to rush in and cool the sheet. The heated sheet, however, has been stretched beyond its elastic limit and retains the bulge. New sediment is added to the scale already formed; it again adheres to the sheet and the bulging process continues. The sheet is distorted around the rivet or bolt-holes, causing rivets and bolts to leak, and if the scale is not removed, the sheet will bulge away from the rivets and bolts and sometimes will strip the beads off the tubes.

When an unusual amount of scale forms around stay-bolts on fire-box sheets, its presence is shown by a white ring around stay-bolt head. As the scale becomes gradually thicker the bolts leak slightly at first, growing worse as the scale increases, and finally through repeated overheating and cooling the sheet becomes brittle, local strains are produced, the sheet cracks and is distorted at the hole, the threads and head are gradually stripped, and the sheet is forced away from the bolt. When a large number of cracks develop, it becomes necessary to either remove a part or whole of the sheet or sheets affected and renew them or take out the whole fire-box and renew it. As this is expensive, let us see how it can be avoided or put off for a number of years.

We will go back to the new boiler and to the time when the boiler-maker made his first report of stay-bolts leaking. There were only a few, and very little was thought of it; as the boiler was being washed thoroughly it was not thought possible that scale enough had formed to make trouble, but let us look into the water space.

Possibly the boiler has a long, shallow box and no wash-out holes were put in below the swell. They were not deemed necessary on account of the shallowness of box. The water-leg was washed from holes in wagon-top and from either end. In washing from the top the water strikes the outer sheet on account of the firebox being narrower on the bottom than top, the force of the water is broken and the inner sheet derives no benefit from the washing.

In washing from the ends the force of the water is broken by the stay-bolts, with the same result—no benefit to the bolts or inner sheet in the center of water-leg. It has been merely a change of water. To prove this let us look into the water space. As the leaks around stay-bolts usually develop near the center of that part of side-sheets below the swell and between the wash-out holes, both in shallow and deep boxes, we will have to drill a hole in outer sheet opposite the leaky bolts, and then we insert a torch and inspect the bolts. What a surprise is in store for us! For around the bolts, next to the inner sheet, layer upon layer of scale has accumulated until it is from 2 inches to 2½ inches in diameter and from 1 inch to 1½ inches thick. How wonderfully it is formed, as though an unseen hand had held it in position until it fastened itself upon the bolts and sheet. We insert a cleaning rod and find the outer scale is still soft, while next to the sheet it is hard and requires a little effort to remove it. We remove all of the scale, caulk the bolts lightly, and they give us no more trouble unless scale is allowed to accumulate again, and this will invariably happen, especially on those parts that are not open for inspection, such as central portion of side sheets and crown sheets of crown-bar boilers.

Should scale on the crown make its presence known by lime around the rivet heads or by particles of coal adhering to the sheet, have dome cap and stand-pipe removed. If all of the scale cannot then be removed, have dry-pipe taken out, and then the scale can certainly be removed. It is less expensive to do this than to allow the crown sheet to be ruined and make its removal necessary.

The crown sheets of radial-stayed boilers are often neglected. On account of their convex surface and the fact that they are usually lower behind than in front, they are expected to take care of themselves. The result is, scale is formed around the bolts at the crown sheet, and if allowed to accumulate the same trouble will be had that was experienced with the stay-bolts in side sheets.

The fire-door also furnishes its share of trouble, frequently on account of too much lap on the inner flange, causing the inner door sheet to crack around the bend. Should scale accumulate on the top of door, it will make its presence known by lime forming along the seam and around rivet-heads. When this makes its appearance a hole should be drilled in back-head and scale removed.

Had the stay-bolts, door and crown sheet of the new boiler received the proper care, they would not have needed any repairs for four years, and then only light repairs, for the proper care of a boiler is just as essential to its efficiency and longevity as good material, construction and workmanship, and it is only by constant, untiring vigilance that the repair of the firebox can be avoided or put off for a number of years. To sum it all up in one sentence, it is simply to take the stitch in time.

Chance for a New Insurance Company.

A recent ride on the third rail electric railroad from Hartford to New Britain, convinced the writer that there is a field for still another class of insurance in Hartford, the city in which apparently two-thirds of the population are already in the insurance business. The other third make bicycles.

The trains consist of one open and one closed car, the open car carrying the motors, and being run ahead, as a matter of course. When an open car runs thirty miles an hour through open country, it is apt to be a trifle breezy, to put it mildly, as one man on the front seat, who was watching the motorman twist the controller handles, found to his sorrow. A little extra gust of wind, and the aforesaid man was doing gymnastic evolutions that would do credit to an expert, but the festive derby eluded all his efforts and went sailing away, perhaps to adorn the scarecrow in the nearest cornfield.

It occurred to the writer that a third rail hat insurance would probably find considerable patronage, if the risks would permit of a low enough premium.

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Compound Locomotives in the Balance.

"The compound locomotive is still in the balance, but is receiving careful attention, and a number of roads are now using compounds in freight service, and a smaller number of compound locomotives are used in passenger service." The above is an extract from the opening address of President Soule, at last Master Mechanics' Convention. Considering the fact that Mr. Soule has had for years about as many compound locomotives under his charge as any man in the country, his talk about that type of engine being still in the balance is not reassuring to those who have been predicting that the compound locomotive is the coming motive power for railroads.

Outside of Mr. Soule's remarks, there were curious and conflicting sentiments to be heard expressed by the men attending the convention. It is customary at these meeting for members to get into groups on the hotel porches to discuss things that are of mutual interest. The discussions among those chair committees are nearly always more interesting than the recorded discussions heard in the convention, and the expression of views and statements of acts have a freedom of expression that savors of honest conviction. The writer listened to several porch discussions with compound locomotives for the subject, and he made up his mind that engines of that kind were not adapted for railroad service, and that their popularity was rapidly waning. But when the subject came up for discussion in the convention nothing was said against the compound, and statements were made concerning the economical operation of compounds as compared with simple locomotives which would seem to indicate that railroad managers who stand on the brink, hesitating to wade into the stream of compounds, are wasting the revenue of their stockholders.

The subject of compound locomotives has been up for discussion at the Master Mechanics' Conventions regularly for eight or nine years, and never before was the testimony unanimous in their favor; but in the discussion at Old Point Comfort every speaker aserted that this type of engine was more economical than a simple engine, doing the work of train hauling at considerably reduced expense. The discussion was opened by Mr. W. S. Morris, superintendent of motive power of the Chesapeake & Ohio, who has had prolonged experience with compound locomotives, is a clear, systematic investigator, has no prejudices in favor of things that will not make money for the company he serves, and who has courage enough to commend or condemn an appliance according to its performance. Of compound locomotives he said:

"In 1893 the compound engine No. 140, on the C. & O., made the record which I gave at the meeting of that year. I have tabulated her performance since that time, and now after a four years' performance—one of the longest recorded comparative performances that has been made between engines of the same class, carrying the same steam pressure, and identical in every respect, except that one is a compound and the other are ten simple engines—give some of the comparisons with the ten engines for the entire time included in the four years. The total mileage in freight service of ten simple engines was 396,633, or an average of about 139,666, as against the mileage of 165,187 for the compound—the percentage being 18.3 in favor of the compound. The repairs were about 1 per cent. more for the compound than they were for the average of the ten simples. The oil and waste consumed for the greater mileage was .02 of 1 per cent. less. The fuel consumed for the increased mileage was 6.0 less than the total fuel. The compound in the four years made 19.2 more miles to the ton of coal than the average of the ten simples, and ran 30.9 more miles to the pint of oil. The cost per mile for repairs was .09 of 1 per cent.; for oil and waste, 8 per cent. less; for fuel per mile, 21.3 per cent. less, and a total less cost per mile of 8.4, as compared with the ten simple engines for the four years.

"A little over a year ago, we rebuilt or compounded six of our class G-5 engines, which are a change from the original G-4. It was designed to carry more steam, and we thought would make a successful compound, using our standard G-4 designs as far as practicable, excepting that we carried 200 pounds of steam on the compound and 165 pounds on the G-4 engine. The fuel performance of these six engines for the year ending January 31, 1896, compared with six other G-3 engines for the same period during the previous year, was as follows: The engine mileage for the G-3 simple, 119,000, as against 120,000 for the G-5 compound. The tons of coal for the simple engines were 7,667; for the compound, 8,456. The cars hauled per mile for the simple were 502, as against 652 for the compound. We expected that these engines would haul a greater tonnage, because they are heavier and carried more steam; but the fuel economy is entirely due to the compounding, and is 16.2 per cent. These engines were operated practically by the same men as the simple engines were during the previous year. Therefore we think that the comparison is highly complimentary to the compound engine."

Six other speakers took part in the discussion, the whole representing over 27,000 miles of railroad, and every man of them spoke as favorably about the economy of compound engines as Mr. Morris did. There was not a dissenting voice in the meeting. This struck us as being curious after the unfavorable comment we had heard outside of the convention. Are members of the Master Mechanics' Association afraid to rise and tell their honest convictions about compound locomotives?

The testimony of the speakers was that compound locomotives saved from 15 to 25 per cent. of the fuel required by a simple engine to do the same work, and that the expense for repairs was not materially different. Now, in view of all this it is passing strange that railroad companies are not running their shops day and night with a full force of men engaged in changing their locomotives into compounds. The fuel bill is one of the heaviest items in railroad expenditures, and a saving of 15 per cent. would enable some railroad companies to pay dividends which have been strangers to that form of pleasure for years. It would also enable railroad companies to take back the men who have been laid off and kept idle, because there was no money to pay their wages. It would do wonders to bring back the prosperity which has been so long promised, but has failed to come—failed, to a great extent, because so many of our railroads are in distressed circumstances. As railroad companies are displaying no activity to obtain the saving effected by compound locomotives, we would like to know what kind of African is in the wood pile—there is something hidden and mysterious about the case.

Influence of the Car Repairer.

Pressed steel car trucks, or trucks made from commercial forms of steel are becoming sufficiently numerous to rival the drawbar and the patent angle cock. They are not, however, pushing aside the familiar, full of faults diamond truck so rapidly as might have been expected. The diamond truck is something like some features of the locomotive—all that is bad theoretically, yet somehow it does the work put upon it fairly well. The men who invent improved trucks would help themselves if they would bow their stiff knees a little to that humble individual, the car repairer. It is not to be supposed that the ordinary designer of improvements on car equipment should stoop sufficiently to consider the convenience or comfort of a car repairer, yet that man of low degree does more to make or damn a so-called car improvements than any official on a railroad.

When the season of good cheer comes around and furnishers of railway supplies are sending out cigars and other manifestations of friendship to those they suppose to be their friends and supporters, the car repairer is entirely omitted from the list. What could a grease annointed workman do to help or mar the fortunes of a car truck, for instance? Those who are familiar with the inside working of car business know, however, that the superintendent of motive power does not report favorably or unfavorably about a car truck from his own personal knowledge. He asks the foreman what he thinks of such a truck from the experience he has had with it in service. The foreman has too many things to attend to to watch the performance of a truck closely, but he asks the intelligent car repairer what he thinks about it, and receives frank and full information.

The car repairer is the real judge and arbitrator on the merits of all improvements applied to cars. Ignoring the convenience and prejudices of that obscure personage has been fatal to more car improvements than all other influences combined. The president may order that the X Y truck shall be applied to all the cars of the road, the superintendent of motive power may give orders that the A & B draft rigging shall be made standard for all cars, the purchasing agent may indicate his preference for the O P brake beam, but all their orders and influence will eventually come to naught if the car repairer does not find the devices more convenient than those they were intended to replace.

These thoughts were suggested to the writer by the criticism made by a sensible and intelligent car repairer on the design of a new freight car truck about to be put upon the market. He insisted that no truck would ever supersede the diamond form which did not admit of wheels being changed without calling for high jacking of the car or for moving the truck from under the car. The small amount of labor required to change wheels seems to be the redeeming feature of the diamond truck, and has kept up its popularity against a host of drawbacks and shortcomings. The designers of improved trucks would do well to keep in mind the most popular feature of the diamond truck. It suits that autocrat of the repair tracks, the car repairer.

Drawing the Mechanical Associations Closer Together.

The Railway Master Mechanics' Association did something at the last convention which may exert a far-reaching influence upon the two leading railroad mechanical associations. There has been for the last twelve or fifteen years a desire manifested to bring the Master Car Builders' and Master Mechanics' Associations into closer connection with each other. It was well known that many general officers of railroads looked unfavorably upon the time taken by their separate conventions, and we have heard the opinion frankly expressed in high places that there was no reason why both associations should not meet at the same time and place and perform their work by alternate sessions. This seemed too radical a change to meet the views of the mass of members, but they were induced to do something to indicate that they heeded the sentiment calling for less waste of time. The Master Mechanics' Association several times intimated that they were willing to meet the Master Car Builders' Association half way in any arrangement that might be proposed, but there was a feeling displayed by the latter associatian that the other wanted to swallow them up, and that delayed action for several years.

The first move of progress was in an agreement entered into by both associations to meet at the same place, the choice of that place to be made by the Executive Committee of both associations. At the same time it was agreed that instead of the Master Car Builders meeting on the second Tuesday in June and the Master Mechanics meeting on the following Tuesday, the Master Car Builders should meet on the second Wednesday in June and the Master Mechanics on the following Monday. This saved two days and was considered a move in the right direction, but two years afterwards the Master Car Builders went back upon the agreement and began meeting on Tuesday. Efforts were made several times to get them to return to the first agreement without avail, and last year the Master Mechanics changed their by-laws so that their meetings should again begin on the third Tuesday of June. This was the arrangement in force when the conventions met at Old Point Comfort last June, and it seemed that the movement to bring the associations into closer relations was drifting backwards.

This undesirable state of affairs was suddenly changed by a courageous member of the Master Mechanics' Association who is not a slave to empty forms or rules of procedure. He rose and proposed that both conventions should meet in the same week and that arrangements to carry that out should be left with a joint committee made up from committees of both associations. We believe that a trial of the new plan will result in the arrangement being made permanent. It will also hasten the inevitable action of consolidating both associations.

Paint Shop Progress.

In the paint shop is the influence of short cuts and special devices for cheapening the cost of work, felt quite as much as in any other department, and the fact is noteworthy because openings there for any startling improvements are not so plentiful as in other branches of trade. The paint pot and brush would seem to the uninitiated to be indispensable to the artist, and accessories that would remain undisputed masters of the profession, but the fertile mind of the progressive foreman has made these time honored adjuncts of his trade occupy but a very narrow field, so restricted, in fact, that they may be said to be no longer factors in the business. This revolution has been brought about by compressed air and the spraying machine. Like all moves looking to a rip-up of traditional teachings, this one met with determined opposition from the parties who did not have anything to do with its development. All that kept life in the weakling was the saving it showed over the best brush work under all conditions of competition.

Graining, as known to the old timers, with its paraphernalia of implements and accessories for counterfeiting nature's handiwork, has also entered the dark confines of the past, forced from its place so long undisputed as the best, and in fact only way to produce the beautiful effects so well known to the admirer of wood graining, to make room for a purely mechanical device to do the work; one more concession to the demand for a lowering shop expense.

The mechanical grainer is simply a solid wooden cylinder of a circumference that will slightly more than equal the length of the piece to be grained, and of a width also equal to the work. With two handles at the sides similar to those of a rolling pin, this cylinder becomes a roller and is used as such to perform graining operations. The periphery of the roller is covered with a combination of molasses and glue, like a printer's roller, and is then ready for use.

Whatever grain it is desired to show, is taken from a piece of wood which is selected and planed on a surface that will give the required grain. The planed face is then covered with the pigment to be used, and the roller is passed over it, which operation transfers the actual grain of the wood to the roller, which in turn is rolled over the surface of the work to be grained, and deposits thereon the grain exactly as taken from the original piece. This is cold-blooded realism, since it faithfully reproduces the grain from the sample and does not depend in the slightest on assistance from the human hand, aside from the menial act of rolling. It seems almost sacrilege to thus easily wipe out of existence the artistic license made perfect through long years of application, by this little Juggernaut of a wooden roller, but sentiment has no place in right shop management and it cannot stay the march of improvement.

Compressed air has its field of usefulness in the paint shop, aside from its employment in the spraying of paint, which is one of its last achievements. It has made a record as a blast for sand cutting on glass, and also left its mark in the carburetting system of burning paint from passenger train cars, it being a common occurrence for five men to burn off a coach down to the wood in nine hours. These are only a few of the most important factors that show the strides made toward turning down the practice of yesterday, but they indicate unmistakably, paint shop progress.

The Master Mechanics' Scholarships.

About seven years ago the American Railway Master Mechanics' Association devoted a fund which they had accumulated to the purchase of four scholarships in the Stevens Institute of Technology, Hoboken, N. J. The object in making this investment was to give the sons of members a first-class engineering education without expense to the parents of the pupils. The association made certain rules which the candidates had to comply with, one being that those who were eligible applicants for the scholarships should have worked at least one year in a machine shop. The effect of this rule was that few of the young men who had been away from school one year, working in a shop, were able to pass the rigid preliminary examination required for entrance to the Stevens Institute. Many of the members wished to have their sons enjoy the benefit of the scholarships, but the failures to pass the preliminary examination were so numerous that the association has not had the education of more than half the scholars they were entitled to.

Recognizing the weak part of the rules concerning the admission of candidates, several members of the association started an agitation at the convention held at Saratoga in June, 1896, and a committee was appointed to recommend changes of the constitution that would overcome the difficulty. That committee recommended that the year of machine shop experience should be dispensed with, and also proposed changing the rules so that any railroad man, sons of any railroad men or of deceased railroad men should be eligible as candidates in case there were not sons of members sufficient to fill all the vacancies. These changes were agreed to at the last convention and the new regulations are now in force.

A circular concerning the scholarships has just been issued by Secretary Cloud, and the intimation is given that two scholarships will be open for candidates at the September examination. We earnestly hope that there will be enough candidates to secure the places, and we wish to make known to railroad men generally that their sons are eligible to secure these valuable prizes.

In connection with this subject we would remind all concerned that the educated engineer is every year becoming more and more in demand for the higher positions in railroad service. It is not now considered sufficient that a man should be a good mechanic to recommend him for advancement on the lines that lead to the top. Everything else being equal, the man who has received a scientific education is preferred to the man who is familiar only with the manipulation part of a mechanic's duties. The change may or may not be an improvement, but it appears to have come to stay, and railroad men having the best interests of their sons at heart should do all in their power to give them the education which is becoming such a powerful lever in pushing people upwards.

The Apprentice Problem.

There seems to be an idea prevalent among many would-be mechanics that they can be an ornament to their business by the exercise of that nerve-force recognized by physicists as "gall." This is especially true in the machine shop, and comes to our observation only when the pretender is forced, by the direst necessity, to ask questions concerning the simplest points of his calling; thus letting light in on his failure to properly prepare himself for his business, either through lack of opportunity, or what is more commonly the case, indisposition to devote the time necessary to acquire a knowledge of even the rudiments of it.

Royal roads to success are becoming fewer as time rolls on. Those avenues having a pull attachment are too few to alarm the man who knows his needs and is fitting himself to cope with the serious side of them; but there are, as intimated above, too many who, after years of practically wasted effort, still delude themselves with the belief that they can hold their positions by assuming virtues they never possessed. The only hope for such talent is a beginning at the bottom and strengthening the weak points by a proper course of instruction, manual and otherwise.

As a proof that there are many of them already laboring under the conviction that knowledge is power, it is only necessary to scan the pages of our best technical publications that make a specialty of imparting information to the inquirer. They are educators and doing an amount of good not measured by words. There is, however, one important part of the question of shop practice that is not comprehensible from a written standpoint, namely, the use of tools—the actual manipulation of the chipping hammer and chisel and also the file. The theory of this work is easily absorbed, but not so the practice, and it is to the want of the latter that so many ambitions are brought to a humiliating standstill.

It is true that the field for these tools is not as extensive as in the past, on account of the great range of machine tools to cover the same ground. It should not be forgotten, even if we concede the above fact, that the time will never come when the hammer, the chisel or the file will not be a part of the equipment of every metal-working establishment, and the expert manipulator of those tools will not be without honor in the land. The inability to handle these tools is what apprises us of the presence in our midst of the fraud—the fakir, who knows how to chip the sprue off a casting, and absolutely nothing about the file, except its adaptability as a doctor for a poor lathe job.

Machinists of this ilk are found in almost every shop in the land— expert, perhaps, in handling some one machine tool, but sadly wanting in the knowledge of the uses of hand tools, or properly tools that require training to handle with precision. It is familiarity with these details of the business that makes a man worthy of his hire, and furnishes the material to equip the successful railroad shop. The "all-around man" will soon be, like the Dodo, extinct, if this system of cultivating the specialist is fostered to the exclusion of proper instruction for our apprentices of the future; to be more explicit, a course of instruction that will make him familiar with his work and the tools he will use while doing that work.

Apprentices, like other people, must be kept on the move, to get results. If they are allowed to use their own judgment, they are quite likely to reach a critical period early in their career, when their zeal for the trade is subordinated to a yearning for rest, and the tool in the shop that affords the most ease, is the job they are looking after; if not dislodged and made to float on, they land high and dry on this rock in the stream of progress, and swell the ranks of those who claim to be what they are not—machinists. The foreman is directly responsible for this condition of things, and to him and his superiors we must look for a solution of the problem of how to bring the machinist apprentice back to the old status, when he will be a credit to those who taught him his business, and an honor to the craft. Make the relations between the foreman and his wards those of father and sons. Give the apprentice a chance, and force him, if necessary, to accept the gift. If this course is followed, there will be fewer "handy men" about the shop; but their places will be filled by mechanics, and the decadence of the apprentice will be at an end.

Government Management of Railways.

The worst managed railways to be found all over the world are those that are operated by the government of the countries where they are. Certain politicians in America always put in a plank in their platform of principles calling for the control of all American railroads by the government. If we are to judge by experience of what the result would be, the indications are that it would be a very expensive policy for the United States Government to assume control of railroad operations.

There is a good object lesson in South America, which ought to have its influence on people in this country when they talk about turning the railways over to government ownership. Most of the railroads in Brazil were built by private capital, and were operated at a profit, the Central Railroad having paid for years a dividend of 9 per cent. A few years ago, the Brazilian Government took control of the railroads, and they have been run at a loss ever since. The Central Railroad of Brazil, which, as has been said, used to pay a good dividend, has cost the government between two and three million dollars more than it earned, and other roads are in a similar condition.

The Brazilian Government is now trying to lease the entire railroad system of 14,000 miles to any responsible company that will pay a bonus of $70,000,000; this bonus to cover the rental of the track, rolling equipment and other property pertaining to the railroad, for a term of fifteen years. There are about 1,400 miles of railroad reported to be in good physical condition. Business connected with transportation in Brazil has been so badly demoralized by the government operating it, that they do not find any capitalists prepared to accept the offer.

Best Cylinder Ratio for Compound Locomotives.

There has always been some conflict of opinion among locomotive designers as to the best proportion of high-pressure and low-pressure cylinders of locomotives. When people began building compound locomotives, they were almost in the dark about what cylinder proportions would give the best results, because stationary and marine practice gave small guidance owing to the different conditions under which locomotives are operated; but they made the low-pressure cylinder double the size of the high-pressure one, and that ratio worked very well. Succeeding designers of compound locomotives changed the ratio somewhat, and engines with a ratio of 3 to 1 are in use.

It has been very difficult to tell how far one might safely go in the enlarging of the low-pressure cylinder until the stationary testing plants for locomotives came into operation. By the use of the testing plant at the Chicago & Northwestern shops, at Chicago, Mr. Robert Quayle, superintendent of motive power, learned some facts about cylinder ratios which ought to be valuable to designers of compound locomotives. He had two compound locomotives which were of the same general proportions and dimensions, except the cylinders, and one was decidedly more economical than the other. The cylinder ratio of one engine was 2.17, of the other 2.49. He bushed the high-pressure cylinder of the engine that had the 2.17 ratio until the ratio 1 to 3 was reached. There was a gain up to 2.5, but after that the efficiency fell off at about the same rate as it increased from 2.17 to 2.5. From these tests we would conclude that a cylinder of 1 to 2.5 is likely to produce the most economical compound locomotive.

We have received a letter from the Correspondence School of Locomotive Engineers and Firemen, 335 Dearborn street, Chicago, which was at first called the Correspondence School of Locomotive Engineering, protesting that they had no intention of infringing upon us when they assumed the first title. They say that they will be able to depend entirely upon their own reputation for doing good work, and that they have not the slightest need to bolster themselves by stealing other people's reputation. The men conducting this school claim that they have had much experience in doing work of the same kind, although it was not among locomotive enginemen. We do not know any of the individuals connected with this school, and cannot express an opinion of their ability to conduct it successfully, but we do know that they have entered a field that would stand cultivating.

The question of a National Railway Museum is being taken up by leading English engineers, who seem to be realizing that the Field Museum, at Chicago, is fast becoming the owner of the great majority of desirable railroad relics.. One engineer expressed the belief that unless something were done immediately, there would be nothing left in England worth preserving, and that their railway history would be lost.

PERSONAL.

Mr. E. P. Wilbur, for the past thirteen years president of the Lehigh Valley, has resigned.

Mr. S. D. Lake, general superintendent of the Port Jervis, Monticello & New York, has resigned.

Mr. H. A. Gillis, master mechanic of the Western division of the Norfolk & Western, has resigned.

Mr. C. O. Parker, division superintendent of the Plant System, at Montgomery, Ala., has resigned.

Mr. C. H. Bosworth, vice-president and general manager of the Chicago, Peoria & St. Louis, has resigned.

Mr. Geo. M. Vose has been appointed superintendent of the Franklin & Megantic, at Kingston, Me., *vice* Mr. F. S. Mead.

Mr. W. P. Harris has been appointed superintendent of the Plant System, at Montgomery, Ala., *vice* Mr. C. O. Parker, resigned.

Mr. John W. Graham, president of the International Trust Company, of Boston, has been elected vice-president of the Flint & Pere Marquette.

Mr. Albert S. Erskine has been appointed master mechanic of the Wiscasset & Quebec Railroad; headquarters at Wiscasset, Me.

Mr. William S. Porter, general manager of the Chicago, Iowa & Dakota, has resigned to take charge of the electric-light plant of Eldora, Ia.

Mr. O. S. Doolittle has been appointed superintendent of the Gettysburg & Harrisburg at Reading, Pa., to succeed Mr. A. M. Wilson, resigned.

Mr. R. H. Soule has resigned as superintendent of motive power of the Norfolk & Western, to accept a position with the Richmond Locomotive Works.

General Manager W. G. Nevin, of the Southern California, has also been appointed general manager of the Santa Fé Pacific, successor to the Atlantic & Pacific.

Mr. Theodore N. Ely, chief of motive power of the Pennsylvania Railroad, received the honorary degree of Master of Arts, conferred by Yale University at their commencement in June.

Mr. J. S. Mills has been appointed superintendent of the Springfield division of the Baltimore & Ohio Southwestern, with headquarters at Flora, Ill., *vice* Mr. W. N. McMahan, resigned.

Mr. J. T. McBride, vice-president of the Duluth, Missabe & Northern, has resigned that position, but will continue as general manager. Mr. William J. Olcott has been appointed vice-president.

Mr. Frederick Rogers, general freight

and passenger agent of the Washington & Columbia River, has been given the additional duties of assistant general manager; headquarters, Walla Walla, Wash.

Mr. A. H. Smith, superintendent of the Franklin division of the Lake Shore & Michigan Southern, has been transferred to the Michigan division, with office at Toledo, O., *vice* Mr. L. E. Johnson, resigned.

Mr. Henry W. Gays has resigned as general manager of the St. Louis, Chicago & St. Paul, and has been appointed general manager of the Chicago, Peoria & St. Louis, with headquarters at Springfield, Ill.

Mr. Philip Allen has been transferred as superintendent of the Kalamazoo division of the Lake Shore & Michigan Southern, to the Franklin division, *vice* Mr. A. H. Smith, transferred; headquarters at Youngstown, O.

Mr. J. A. Jordan, vice-president and general manager of the St. Louis & Hannibal, has also been appointed general manager of the Green Bay & Western, *vice* Mr. S. W. Champion, resigned; headquarters, Green Bay, Wis.

Mr. W. S. Hoskins has been appointed general manager of the Chattanooga Southern, to succeed Mr. M. F. Bonzano. He was formerly chief clerk to Manager Van Vleck of the Atlantic system of the Southern Pacific.

Mr. Albert Ingalls, son of President Ingalls, of the "Big Four," has been appointed assistant to Mr. T. J. Higgins, superintendent of the Indianapolis & Cleveland division of the Cleveland, Cincinnati, Chicago & St. Louis.

Mr. S. R. Ainslie has been appointed president and general manager of the Chicago Terminal Transfer Company. Mr. Ainslie was formerly general manager of the Chicago Northern Pacific and the Chicago & Calumet Terminal.

Mr. Frank Hufsmith, master mechanic of the International & Great Northern, has been promoted to superintendent of motive power and rolling stock, headquarters at Palestine, Texas. The office of master mechanic has been abolished.

Mr. John M. Savin, general manager of the Quincy, Omaha & Kansas City, has been appointed general manager of the Omaha, Kansas City & Eastern, which road has been formed to operate the Omaha & St. Louis and Quincy, Omaha & Kansas City.

Mr. W. H. Lewis has been appointed superintendent of motive power of the Norfolk & Western, succeeding Mr. Soule, resigned. He was formerly master mechanic of the Chicago, Burlington & Northern at La Crosse, Wis.; headquarters at Roanoke, Va.

Mr. R. D. Wade, who was for many years superintendent of motive power of the Richmond & Danville, afterwards absorbed by the Southern Railway, has accepted a position with the Baldwin Locomotive Works. It understood that he will work in the interest of this company among his numerous friends in the South.

Mr. M. F. Bonzano has been appointed general agent for the receiver of the Columbus, Sandusky & Hocking, with headquarters at Columbus, O. He has been general manager of the Chattanooga Southern since the early part of 1896, and previous to that was general superintendent of the Philadelphia & Reading.

Mr. D. J. Durrell has been appointed master mechanic of the Kansas City branch of Swift & Co.; headquarters at Kansas City. About five years ago Mr. Durrell resigned the position of mechanical engineer of the Illinois Central Railway, to accept a similar position with the Illinois Steel Company, which company he has been with since.

The following changes have recently taken place on the Mexican Central: Mr. F. J. Easley, superintendent of the San Luis division, has been appointed terminal superintendent at Tampico, Mex., succeeding Mr. R. M. Thomas, resigned. Mr. H. R. Cornforth has been appointed acting superintendent of the San Luis division, at San Luis Potosi, Mex., *vice* Mr. F. J. Easley, transferred.

The following have been appointed officers of the Chicago, Indianapolis & Louisville, successor to the Louisville, New Albany & Chicago: Samuel Thomas, president; W. H. McDoel, vice-president and general manager; George K. Lowell, general superintendent; L. H. Parker, superintendent; H. Watkeys, master mechanic; Charles Coller, master car builder, and B. E. Taylor, purchasing agent.

Mr. George Gibbs has resigned the position of mechanical engineer of the Chicago, Milwaukee & St. Paul to accept a position with the Westinghouse Electric Company of Pittsburg. The understanding is that Mr. Gibbs will be engaged in designing electric motors adapted for surface railways. Mr. Gibbs is one of the ablest railroad mechanical engineers in the country, and the Westinghouse Electric Company have reason to be gratified at securing his services.

Mr. W. A. Hart, division superintendent of the Great Western Railway of England, the railway over which royal personages generally travel between London and Windsor, has lately received a present from the Prince of Wales of a handsome diamond scarf-pin. This had scarcely adorned the superintendent's scarf for a week, when he received a still more handsome pin from the Prince of Bulgaria. This one is adorned with the prince's monogram in brilliants, and is surrounded by a golden crown.

Notice has been given of the following changes on the Great Northern: Mr. W. T. Tyler has been appointed superintendent of the Willmar division, taking the place of Mr. J. Russell, transferred; Mr. R. H. Bowron has been appointed superintendent of the Breckenridge division, taking the place of Mr. F. L. Corwin, resigned; Mr. J. Russell has been appointed superintendent of the Dakota division, *vice* Mr. J. G. Taylor, transferred; Mr. J. G. Taylor has been appointed superintendent of the Montana division, *vice* Mr. R. H. Bowron, transferred.

On July 4th, the Southern Railway created three new divisions, which will be known as the Washington, Asheville and Anniston divisions. Mr. E. Ryder, assistant superintendent of the first division, has been appointed superintendent of the Washington division; headquarters at Charlottesville, Va. Mr. W. O. Sprigg, assistant superintendent of the third division, has been appointed superintendent of the Asheville division; headquarters at Asheville, N. C. Mr. A. G. Jones, assistant superintendent of the sixth division, has been appointed superintendent of the Anniston division; headquarters at Selma, Ala.

Mr. Alfred Walter, president of the Delaware, Susquehanna & Schuylkill, has been chosen president of the Lehigh Valley, *vice* Mr. E. P. Wilbur, resigned. Mr. Walter, who is 46 years old, has been a most successful railroad man. He received his first training on the Pennsylvania Railroad, part of the time being in the engineering department and part of the time in the mechanical department. In 1892 he left the Pennsylvania to become general superintendent of the Baltimore & Ohio lines east of the Ohio River, a position he left to become general manger of the Erie. A large number of warm friends are rejoicing at his good fortune in becoming head of the Lehigh Valley.

The death of E. M. G. Eddy, Chief Commissioner of Railways in New South Wales, has occasioned deep regret in railroad circles, particularly in Europe, where he was better known. Mr. Eddy received his early training on the London & Northwestern, and had risen to be assistant manager of the Caledonian Railway before his appointment to New South Wales. Before his arrival in Sydney, the railways were under control of a commissioner, who was subject to political influence from various directions, which gave the colonies a very poor railway service. All this was changed by Mr. Eddy's non-political management, which, according to reliable accounts, gave the country a modern railway service on an economical basis.

Mr. L. E. Johnson, superintendent of the Michigan division of the Lake Shore & Michigan Southern has been appointed general superintendent of the Norfolk & Western, with headquarters at Roanoke, Va. Mr. Johnson rose to official position through the mechanical department. He was born in Aurora, Ill., in 1846, and went to work in the shops of the Chicago, Burlington & Quincy, after which he was appointed fireman. A few years afterwards he became a locomotive engineer, a position he left to become engine house foreman. Later on he was advanced to be master mechanic of the Chicago, Burlington & Quincy shops at Aurora, from which position he was promoted to be division superintendent. In 1888 he left the Chicago, Burlington & Quincy to accept a position as superintendent of the Montana Central. He remained there till 1893, when he accepted a division of the Lake Shore & Michigan Southern. An element which has greatly helped Mr. Johnson on his way upwards was the happy relations which always existed between him and the men under his charge.

David W. Caldwell, president of the Lake Shore & Michigan Southern Railway and the Pittsburg & Lake Erie Railway Companies, died on July 20th, in Cleveland, O. His foe was rheumatic gout, with complications, which attacked him the week before he died. Mr. Caldwell was born in Massachusetts in 1830, and on attaining his majority he entered the service of the Pennsylvania Railroad as a clerk. Perfecting his knowledge of civil engineering, he was employed as civil engineer by this company from 1853 to 1855, when he became superintendent of the Pittsburg & Connellsville Railroad. In 1859 he began ten years' service as superintendent of the Central Ohio Railroad. The next five years were passed as general superintendent of the Columbia, Chicago & Indiana Central Railway. From 1874 to 1882 Mr. Caldwell ocupied various railroad positions of trust and responsibility, becoming vice-president of the New York, Chicago & St. Louis Railroad, of which he was for two years—1885 to 1887—receiver, and from 1887 to 1895 president. He succeeded John Newell as president of the Lake Shore in 1894, and became president of the other Vanderbilt line, the Pittsburg & Lake Erie, in 1895.

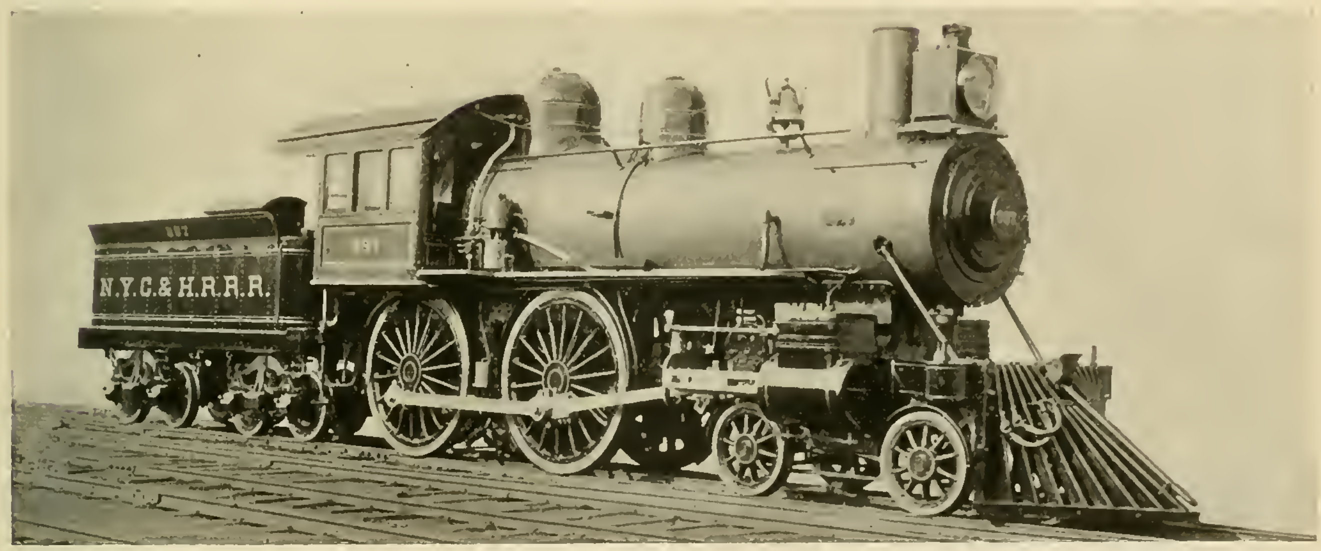
Another Fast Run.

The Empire State Express on the New York Central, has put up a new record for a continuous fast run. On July 16th, the train left Syracuse for Buffalo, 23 minutes late, and made the distance of 149 miles between those points in 143 minutes; this time includes a stop of two minutes at Rochester, together with the various slow-ups that are necessary at all times. The average speed, therefore, from start to stop, was 62.5 miles per hour.

The fastest time was made from the top of the hill west of Batavia to East Buffalo, which is 32 miles run, in 26 minutes, which is very close to 74 miles an hour. Such a speed for the long distance is unparalleled.

An engine of the same class shown in the annexed engraving made this remarkable run. It was designed by Mr. William Buchanan, superintendent of motive power, and built by the Schenectady Locomotive Works. The cylinders are 19 x 24 inches, driving wheels 7 feet diameter, and the boiler provides about 2,000 square feet of heating surface and steam at 180 pounds pressure.

The Ohio Falls Car Company are building one passenger car for the Lexington & Eastern Railway.



LATEST NEW YORK CENTRAL RECORD BREAKER.

EQUIPMENT NOTES.

The Champino Railroad are having five cars built by Carter Bros.

Mr. W. D. Ellis is having one freight car built by Murray, Dougall & Co.

The Ocas Railroad Company are having five freight cars built by Carter Bros.

The Baldwin Locomotive Works are building one engine for James H. Law & Co.

The Illinois Central have divided an order of twenty engines between Rogers and Brooks.

The H. J. Heintz Company are having three freight cars built at the Middletown Car Works.

The Pennsylvania Railroad are to build 200 class X G box cars at their Fort Wayne shops.

The Pullman Car Company are building 200 freight cars for the Kansas City, Pittsburg & Gulf.

It is reported that the New York, Ontario & Western are about to order ten passenger cars.

The Elliott Car Company are building 70 freight cars for the New Orleans & Eastern Railroad.

Four engines are being built for the Kayo Railway of Japan at the Brooks Locomotive Works.

Two ten-wheelers are being built for the Southern Railway at the Richmond Locomotive Works.

The Grand Trunk Railway are having ten freight cars built by the Michigan Peninsular Car Company.

The Inter-Oceanic Railway are having 100 freight cars built by the Missouri Car & Foundry Company.

The Mexican Central Railway are having 128 freight cars built by the Michigan Peninsular Car Company.

The Cooke Locomotive Works are building one six-wheel connected engine for the Morris Co. Railroad.

The Washington Coal & Coke Company are having 100 freight cars built by the Barney & Smith Company.

The Brooks Locomotive Works have an order for ten passenger and ten freight locomotives for the Mexican Central.

The Mather Stock Car Company are having four freight cars built by the Indianapolis Car & Foundry Company.

The Baldwin Locomotive Works are building two consolidation engines for the Columbia & Puget Sound Railway.

The Ogdensburg & Lake Champlain Railroad have ordered one passenger car from the Barney & Smith Company.

The Ohio Falls Car Company have received an order for 50 flat cars from the Cincinnati, Portsmouth & Virginia Railroad.

The Chattanooga Car & Foundry Company are building 300 cane cars for the Magnolia Plantation at Plaquemine Parish, La.

The Brooks Locomotive Works are building three six-wheel connected passenger engines for the Pittsburg, Bessemer & Lake Erie.

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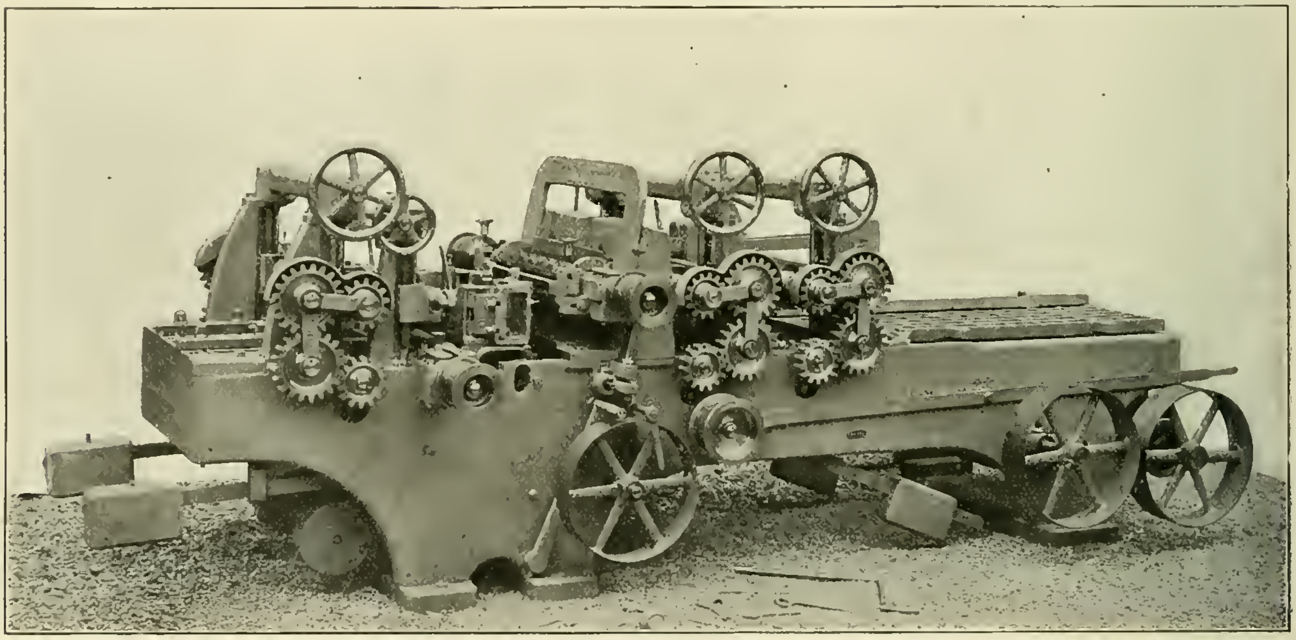
Double Cylinder Planing and Matching Machine.

The double cylinder planing and matching machine shown in the annexed engraving is the latest tool turned out of the J. A. Fay & Co. factory at Cincinnati, O. For heavy work as well as for all ordinary ceiling, siding flooring, etc., the tool is said, by the makers, not to be compared with anything else they have made.

The rolls are six in number, 7 inches in diameter; the upper feeding-in rolls are made so that two pieces of unequal thickness may be planed at one time on two sides and one edge. These rolls are independently weighted and are raised and lowered by means of hand wheels as shown, and their position with reference to the material indicated by an accurate gage that is set in a recess in each housing that carried the roll. The rolls are driven by heavy gearing, with expansion gears connected and supported by links on each side of the machine.

The pressure bar before the cut of the upper cylinder is divided, and just in front of the bars supported in the housing that carries the bars themselves are two rolls 4 inches in diameter, which receive the material and lift up the bar in the proper manner to receive the stock should there be too great a variation in the thickness of the material for the bar to take care of it independently. This is a very valuable feature, and with it all tendency to clipping of ends is avoided. The bar both before and after the cut of the upper cylinder is adjustable about 1½ inches, so that irregular shaped knives may be used on the cylinders for working casing, and other styles of moldings, beaded ceiling, etc. The bar after the cut is slotted and is made to support shoes for resting on the material and holding it in position as it passes to the side heads. The side heads are located just after the upper cutting head in heavy hangers that are provided with the improved drop matching attachment for independently lowering the whole matching mechanism below the line of the bed. The drop matching attachment is counterbalanced and is easily worked up after being lowered. The top plate of the matcher hangers is made independent of the balance of it and bolted to it. When an accident occurs in the use of the machine that results in the breakage of this top plate, it may be readily removed and another put on in its place, thus avoiding the necessity of having an entirely new hanger in place of the damaged one. This lessens the liability of heavy cost in repairs. The matcher clip is arranged with an adjustable toe so that it can be moved to and from the cut, and attached to the clip is a hood to which the shaving exhaust pipe is connected, and whenever it is necessary to remove this to get at the heads, it is done by simply loosening the two bolts as shown in the engraving, when the whole mechanism slips off. There are matcher dogs connected to the hangers, projecting past the cut of the matcher heads for holding the material firmly down before the cutters strike it.



J. A. FAY & CO.'S NEW DOUBLE CYLINDER PLANING AND MATCHING MACHINE.

The matcher hangers are moved by independent screws across the bed of the machine, each one with an independent lock attachment that can be readily reached by the operator. The pressure bar over the lower cylinder has the improved locking device for holding it in position. The cylinder is securely locked in its position by patent taper bolts that have been used on all this company's heavy planers. The lower cylinder is double bolted; the upper cylinder raises on heavy square thread screws 1 5-16 inches in diameter. The cylinder pulleys are put on a taper bearing and fastened by a nut from the outside.

Air=Brake Department.

CONDUCTED BY F. M. NELLIS.

Dummy Couplings.

The hostile attitude of those unfriendly to the dummy coupling because of its failure to satisfactorily perform its office, seems to be modifying, if the discussion on the subject at the recent M. C. B. convention has any significance.

It is an undeniable fact that the improper location of the dummy has been directly responsible for ruining hose by kinking. But has not some of the kinking been largely due to the angle-cock being turned a little too far or a little too short on the train pipe? Perhaps some of the kinking laid to the door of the dummy coupling was really caused by the hose nipple being turned too far or not far enough into the angle cock. Again, perhaps the quality of hose used might have made it almost as difficult to bend without kinking as we would expect from a tin pipe.

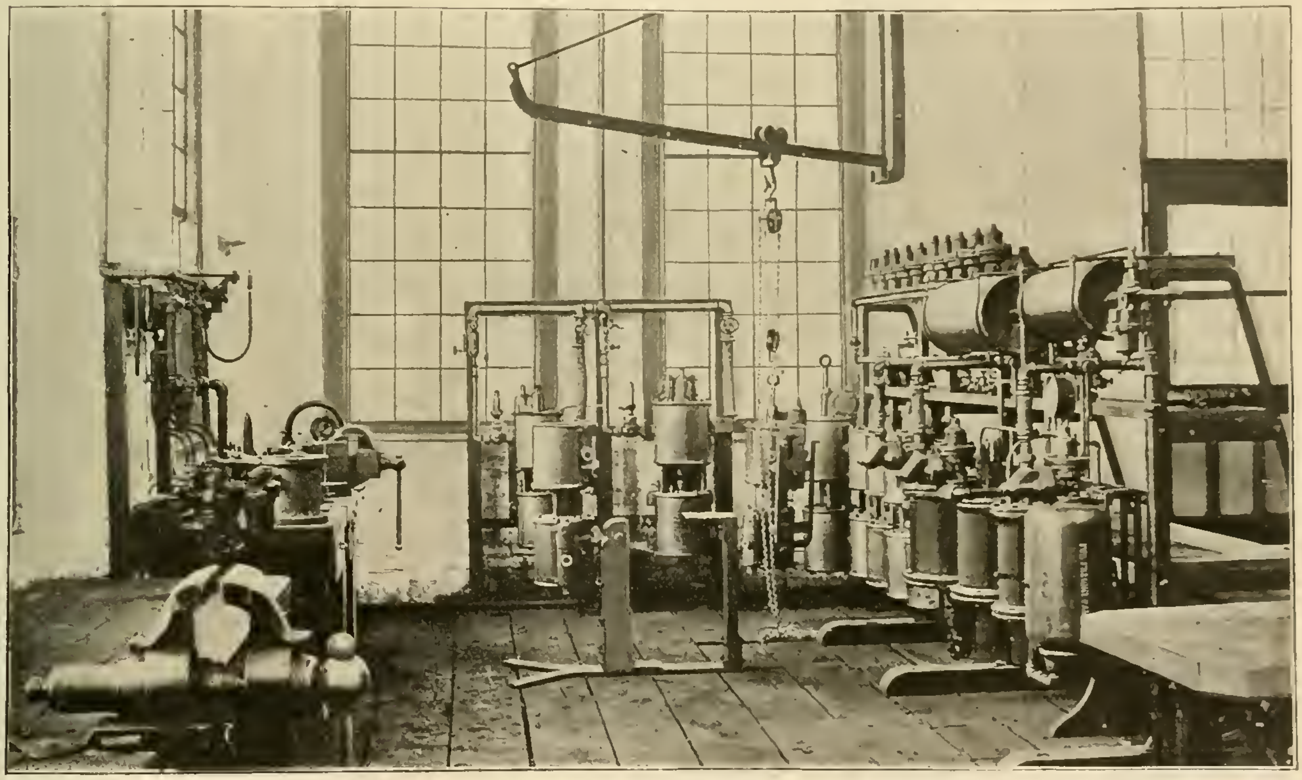
Possibly the design of dummy was not what it should be. But whatever the cause, or causes, of the hose kinking may have been, the abandonment of the dummy hook, and the adoption of the practice of dragging the hose through dust, cinders, snow and slush has not resulted in an unmixed blessing. The kinking has probably ceased, except in cases were those of the tin-pipe type continues to kink and crack at each swing of the hose; but the grinding out of triple valves resulting from foreign matter getting therein, and the frozen triples and train pipes reported during the past two years seem to indicate that unless the practice of abandoning the dummy coupling hook be materially modified, we may expect to soon face another problem, equally, if not more serious than that of dummy couplings which swept over the country like an epidemic about two years ago.

A device which will properly protect the hose, coupling and gasket, and exclude dirt and moisture from the brake system, is needed. The Air-Brake Association, in a committee report at their Nashville Convention, gave the following sensible prescription:

"The committee recommends that the hose should be properly hung up in the coupling hook when not in use; and if the present hook manufactured or place of attaching it to car be unsatisfactory, that the agitation be in favor of a betterment of these features, instead of dispensing with it; as, in the opinion of the committee, the wear of the several working parts of the triple valve is materially increased by the dirt gaining entrance to the air-brake system by hose dragging."

Air brake school rooms, testing plants and instruction cars seem to be growing in popularity and number. A road is away behind the times which does not have one or the other.

Don't neglect to get the latest book on air—the report of the Air Brake Men's Nashville (1897) Convention. Just out of the press. Send us 50 cents for a handsome embossed covered copy, or 75 cents for a leather bound copy.



AIR-BRAKE REPAIR AND TESTING PLANT, SOUTHERN RAILWAY, COLUMBIA, S. C.

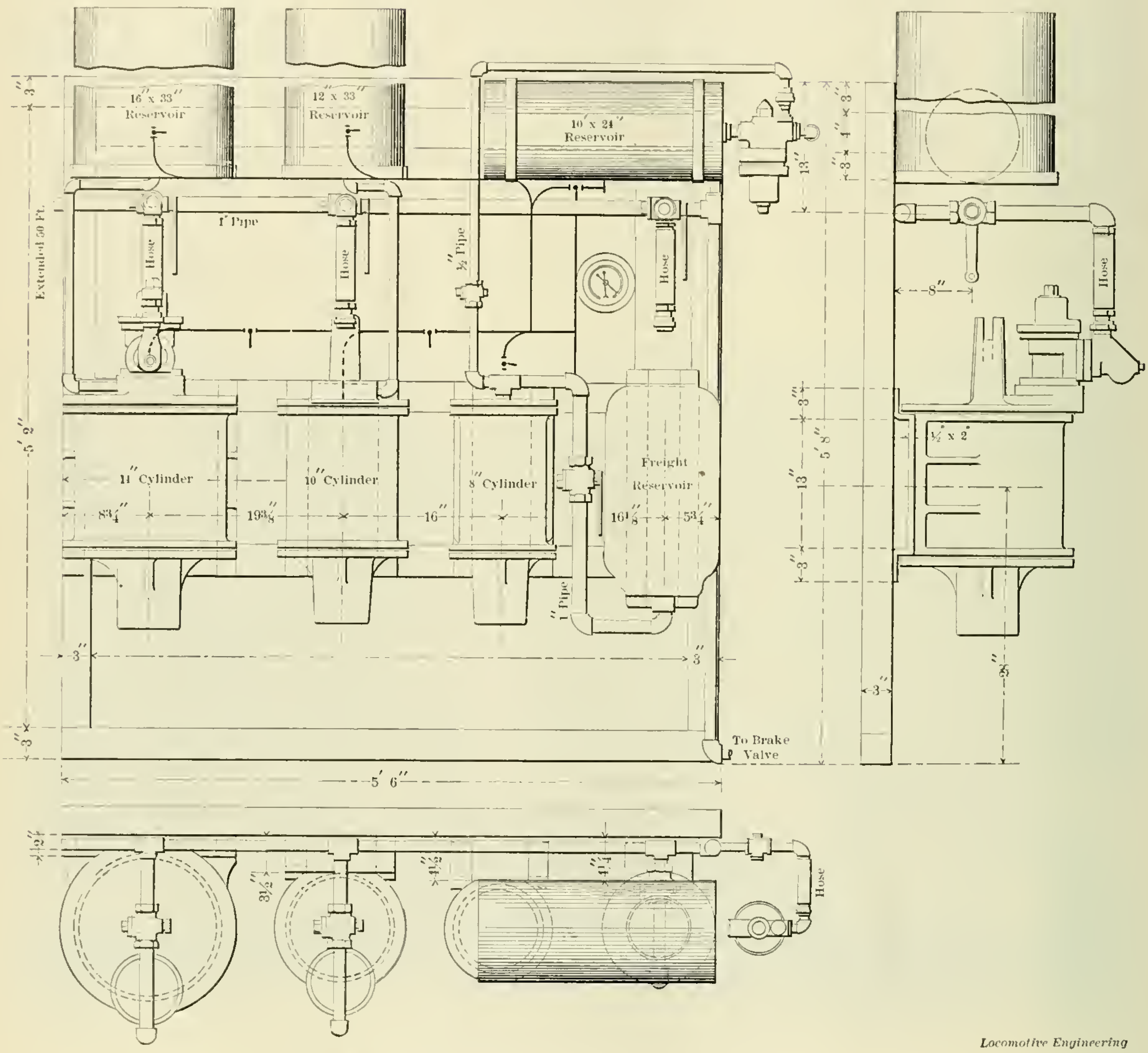
The standard tender brake on the Georgia Southern & Florida Railroad is the type recommended by the W. A. B. Co. All engine tenders are weighed without water or coal, but have the jacks and other tools on them, and the leverage is then arranged so that the tender brake is adjusted at 100 per cent. From the date of adoption of this type until the present time not a single pair of slid flat wheels have been removed from a tender, while previous to that flat wheels were quite a common occurrence.

CORRESPONDENCE.

A Model Air-Brake Repair and Testing Plant.

Editors:

In order that brakes may be maintained at the least cost, proper facilities for doing this work should be provided. This is apparent to us all. But in looking through railroad shops, even the latest designs, we fail to find any special arrangement made, or space set apart for air-brake repairs.



STANDARD TEST RACK FOR TRIPLE VALVES, SOUTHERN RY.

If questioned, one and all will admit that a room for such a purpose should be provided and suitably equipped; but even this admission is of little use to the repairmen, whom we often find occupying a bench in the main shop, the delicate parts of the brakes faring alike with the heavy engine machinery. The rack for testing pumps is in the boiler or engine room. Tests for engineers' valves, triples, etc., equally as inconveniently situated. Last, but not least, a partnership in the lye tub, a driving-box and feed-valve attachment. Companions in the same tub.

But what are we to do? Rooms suitable for such a purpose are not easily found, and to build is almost out of the question. However, I submit the following, as the practice followed on the Southern Railway. 1st: A part of the engine or tool room, or one of the four corners of the shop must be secured. A frame must then be constructed, the bents of which are of 1¾ x 1¾-inch angle iron, the base and shelving of wood. This frame has a four-fold advantage: First, to separate the repairmen from the usual surroundings. Secondly, as a rack for storing pumps that have been repaired, tested and are ready for service. Thirdly, as a triple test rack, and fourthly, the shelving as storage for parts repaired and parts awaiting repairs. The importance of this plan can best be appreciated when the brake apparatus is seen scattered over the floor, and again when arranged systematically on shelving.

Next in order is the pump rack, which can be clearly seen in the accompanying photograph, and a drawing which is also furnished. This is simply a rectangular frame of wood, securely bolted to the wall, iron knees projecting out, to which are bolted two sections of angle iron in a horizontal position, so spaced as to suit a 9½-inch pump. Two flat strips being used for the 8-inch pump.

The test rack for engineers' valves, signal and reducing valves, you will note in the photograph, a drawing also being furnished. This has two places for testing engineers' valves, for while one is being repaired the other can be used to operate the triple test rack. The old and new reducing valves have each a place for test, and like the engineers' valves, have stop cocks so arranged that either way may be used at pleasure.

The triple test rack shown in the photograph differs from that shown in the drawing, but this difference is only in the frame. In the former it is attached to the storage frame, while in the latter it has a frame of its own. With it all classes of triples can be tested. Flexible connections are used to facilitate placing and removing triples from the rack.

Placed just in front of the work bench, and nearly in the center of the floor, is a piece of apparatus known as "pump tipple," and is very valuable in pump work. When a pump is to be put together, the air cylinder is first bolted to a yoke, which is pivoted to the main post of the tipple. This brings the air cylinder in a vertical position, in position for the center piece, air cylinder and top head. Then by means of the pivot of the yoke, the pump can be swung backward, the steam cylinder resting on the smaller post, which places the pump in a horizontal position ready for the bottom head, lagging and jacket, after which it is again swung to a vertical position to be lifted by the crane and placed on the test rack. The tipple is shown in the photograph with pump in vertical position with top head removed. A drawing is also furnished.

The crane is a simple affair, needing no explanation, the photograph being sufficient.

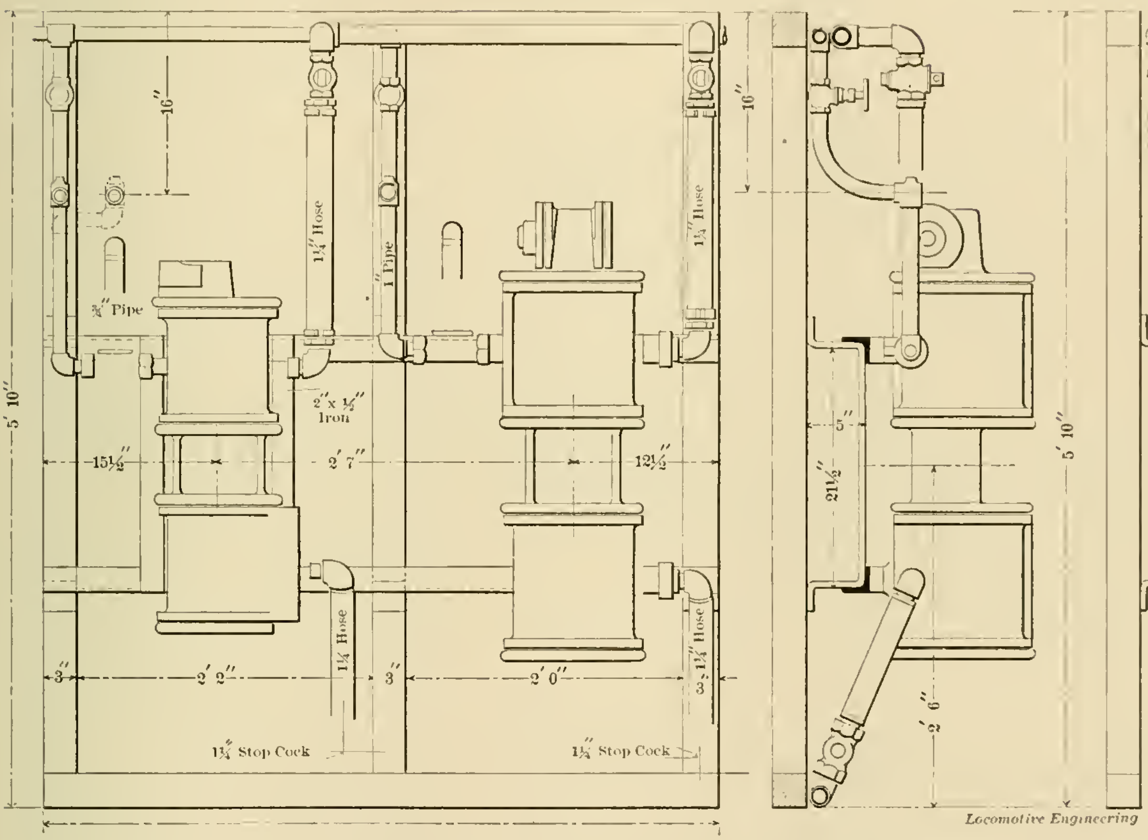
The lye tub, not shown, comes in for a brief description. It is either of cast or plate, and should be of sufficient size to take in two 9½-inch pumps when taken apart. It has a coil of pipe, lying flat on the bottom, with inlet and outlet for steam and condensation. A false bottom, perforated, to the four corners of which are attached chains, for lifting either by windlass or air hoist.

After material is treated to the lye bath, steam is jetted into all ports by means of a steam nozzle, after which it is treated in a like manner by cold water jets. The plant only needs one more piece of apparatus to make it complete, and that is the machine for fitting up air hose, and this in turn will be supplied.

The plan herewith illustrated, has just been completed at the shops of the Southern Railway at Columbia, S. C., of which Mr. T. S. Inge is master mechanic. Although this is one of our smaller shops, yet none can boast of a more complete air-brake test plant. This same arrangement by lengthening the storage frame can be used in shops of any size, its length simply being determined by the number of pits in the erecting shop.

W. F. Broadnax,
Air Brake Inspector,
Southern Railway.

Richmond, Va.



STANDARD TEST RACK FOR AIR PUMPS, SOUTHERN RY.

An Opinion.

Mr. Editor:

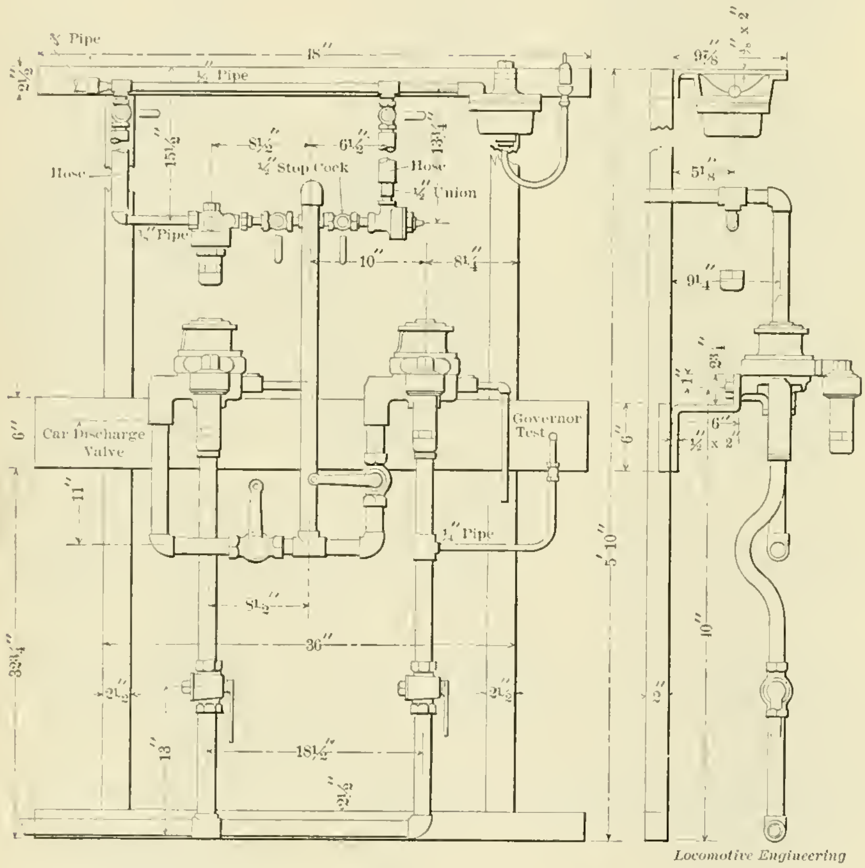
Dear Sir. in reply to the invatation at the bottom of the description of the duplex Air Brake. I can see no plaice to take hold of or to condridict. in my oppinion. this is a moddle air brake. I have always been a firm beleaver in a double line air brake. though I must admit this is far beyond my expectations. the Engineer haveing conpleet controll of the applycation and Release of Brakes, releasing as he wishe and stoping the release when he likes, and being in the position to see at all times by the tripple Gauge Just what he is doeing I know would be the best guide to good Breaking of traines, and the Equallisation of pressure against all brake cylinder pistons. regardles the travel of the same. with an equal applycation and an equal release. ceartenly will save lots of trouble and flat Wheels. this system is something entirely New to the Air Brake

World. and I beleave it is in the right line. this prooves beyond a doubght that we do not want a standard brake. all over the World. I beleave Nothing could ever be made to compeet with the present Air Brakes, in a single line. but Here comes something New that does all we have been doeing and ten times as much more, and now that we see such an improovement. where we suposed there was so small a chance, what might we expect in the future. it is Verry evident that there will be improvements in this line for time to come. but if it goes in strides like this we may as well stop studeying. for we no sooner learn something, than we begin on something New yours Truly

JOSEPH MILLER.

Louis Ville, K. Y.

[A model brake! Nothing to contradict! Far beyond expectations! Entirely new to the air-brake world! Does all we have been doing (?) and ten times more! Such terrific strides! Oh, Joseph! What an investigator! Where are your eyes?—Ed.]



STANDARD TEST RACK FOR ENGINEER'S BRAKE VALVE, SOUTHERN RY.

Concerning the Marsh Recharging Device.

Editors:

I have studied with considerable interest the Marsh Pressure-Retaining and Recharging device illustrated in the April issue of "Locomotive Engineering." It appears to me the most feasible of anything designed for that purpose that I have yet seen.

During the last few years, presumably like many others in a like position, I have been appealed to by several inventors to make a test of some device of theirs intended as an automatic pressure retainer. In a few instances where they have been sent with the proper authority, brakes in the instruction car have been equipped and considerable time has been spent experimenting before their valves were perfected on one car to their satisfaction, to be finally knocked completely out when used in conjunction with more cars or for various other practical reasons.

While I do not suppose that Mr. Marsh has gone to the trouble and expense of models and patents without previous successful experiment, however, from my understanding of the drawing and explanation, if the usual exhaust port were closed and a triple valve defective (having a leak to the cylinder from either the auxiliary or the train line), the brake would set while recharging the auxiliaries. I think this device could be so altered as to make it operative from the locomotive entirely instead of requiring the trainmen to turn a cock on each car before and after descending a grade. What objection would there be to lengthening the feed port in the triple piston cylinder so that it would remain open when Marsh triple stands in its normal release position? This would obviate the necessity of a movement of the triple to overcome auxiliary leaks. Then the pet cock used could be placed on a car in the location of the present retainer and remain closed at all times except on a car having a blow in the triple valve.

I should be glad to hear what results were obtained from his experiments on defective cars, and to hear if he proposes to make it operative solely from the engine, if Mr. Marsh will be good enough to explain through your columns.

E. W. PRATT,
Gen. Air-Brake Inspector.

Chicago, Ill.

[Will Mr. Marsh kindly write us the desired information for publication?—Ed.].

Backing Trains into Stations.

Editors:

Relative to the subject of backing trains into stations. Equipment is handled with the "back up hose," by the roads running out of Union Passenger Station, Chicago, over stretches of track measuring from one-half to four miles in length; the various yards being located as follows: Two, one-half mile from station; three, one mile; one, one and one-half miles; one, three and one-half, and one, four miles distant.

At the speed at which these back-up movements must of necessity be made, there is plenty of time for loss of auxiliary reservoir pressure as mentioned in my letter appearing in the June number, the trouble being practically that experienced on the road through stoppage of the pump and consequent loss of pressure by leakage and equalization. On the joint tracks, traffic is very heavy and during certain portions of the day trains must be handled with the precision of clock-work or blockades result. With the brake valve in the advised position (on lap) an attempt to reduce speed, frequently necessary to preserve the space interval required for safety, will, provided pressure has not been lost, stop the train and occasion delay.

Under the circumstances I think you will agree with me that the one safe and practical place for the brake valve handle during these movements is the running position.

E. H. DE GROOT, JR.,
C. B. & Q. R. R.

Downes Grove, Ill.

[This part of the subject is touched upon in the latter part of our comment on "Backing Trains into Stations," on page 459, of June number.—Ed.]

A Dirt Guard.

Editors:

As a dirt guard for opening of air hose is desirable, I attach a drawing showing a very simple arrangement which may be an incentive toward a solution of this

DUST GUARD.

problem. It consists of an ordinary iron stopper attached to the hose clamp, or otherwise by a chain. No patent.

J. A. Jesson,
L. & N. Ry.

Nashville, Tenn.

Regarding Willett's Duplex Air-Brake System.

Editors:

In July number of "Locomotive Engineering" I notice that the gentlemen who criticise the above-named system seem to see no room for improvement in the present system, and give to Mr. Willett scant thanks for his attempt to improve, if it should be no more than an attempt.

Now, speaking of the quick-action feature, which seems to be almost of major importance, I would like to point out one defect (to my mind) in making an emergency stop on, say, a 50-car train equipped for quick action. The first car scoops up a certain percentage of train line pressure; the next car scoops up a lower pressure, and so on back to rear end of train, with the probable result that first car may exert, say, 60 pounds to the square inch, while others will vary and get less. The last car only shows, say, 40 pounds to the square inch.

Now, if Willett's system is not quite so quick an action, yet he gets full 60 pounds to the square inch on the entire 50 cars, which will more than compensate in stopping quick than the slight gain in time at the expense of lost pressure.

Second, I notice Mr. Otto Best speaking of the equalizing piston feature as though it was only second in importance to the quick action. Now, while I believe the equalizing valve is a first-class mechanical contrivance, yet it is not infallible, and consequently is a very, very dangerous thing under certain circumstances. For instance: An engineer is nearing a station. He makes a reduction from the equalizing reservoir. The black hand registers the reduction, and the engineer hears the escape from the preliminary exhaust port. He waits to feel the brakes check the train, but they do not. Why? Because the equalizing piston is stuck, and he is now too near the station to stop without using the emergency.

This proves the equalizing piston dangerous at times, and shows up one good point in the Willett system, viz., that of showing engineer by third hand on gage the brake cylinder pressure.

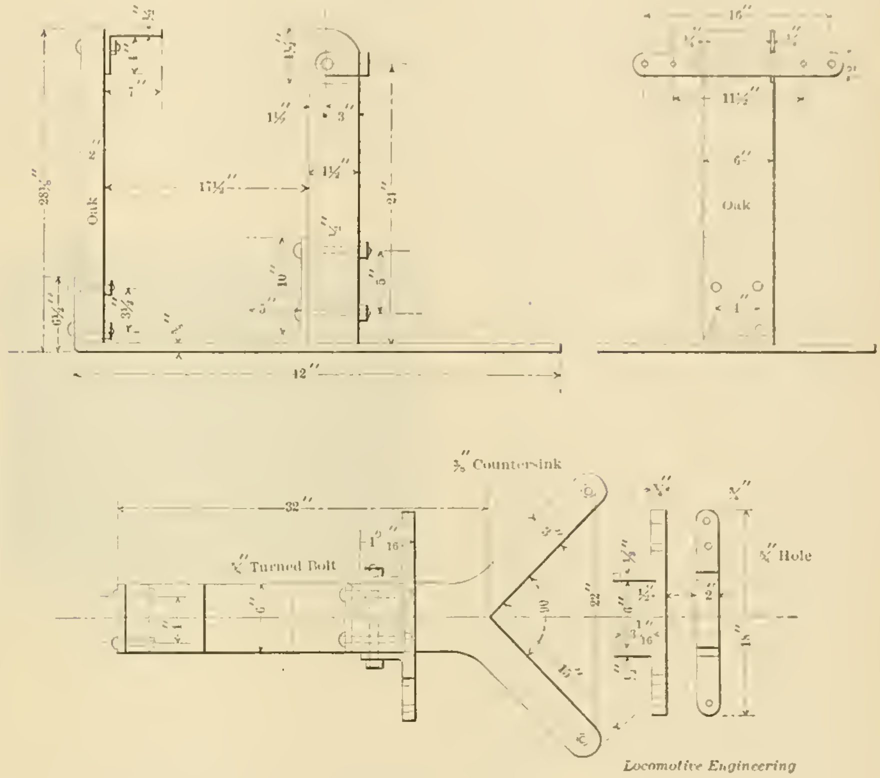
Ernest Armstrong,
Air-Brake Insp., Loco. Dept., P. R. R.

Camden, N. J.

[The "scooping" process does not diminish in force as it travels toward the rear in the manner assumed in the above article. In an emergency application each cylinder has an equal opportunity to draw from the train-pipe pressure, regardless of its position in the train.

The M. C. B. code of tests for triple valves requires that the fiftieth car cylinder shall have 45 pounds in three seconds from the first movement of the engineer's valve handle, and at least 55 pounds in three and one-half seconds. The final maximum pressure must not be less than 15 per cent. nor more than 20 per cent. above the pressure given by the same brake in full service application. Seventy pounds train line pressure is used in making these tests. Both rack tests and running tests prove that the first and fiftieth cars get practically equal pressures on the same emergency application.

The necessity for an equalizing arrangement to automatically control the discharge of pressure from the train pipe to prevent head brakes from "kicking off" is so well known and established that discussion of that feature at this time would be superfluous and untimely. It is possible that the equalizing piston might refuse to respond to a reduction in the equalizing reservoir pressure, providing neglect or abuse has allowed it to corrode and become solid with its cylinder; but no valve in this condition should be allowed in service, and is not permitted on railroads where brakes are looked after.



STAND FOR ERECTING AIR PUMPS, SOUTHERN RY.

An equalizing piston in reasonable condition can be depended upon to operate with the same equal surety and regularity which marks the action of the piston in the triple valve. It is not whimsical. If it works once it will work again and again, and will continue to work without a failure until it wears out or gets into the disreputable state above mentioned. Then the valve should be conditioned or taken out of service.

An engineer's busiest time is when he is stopping. Even if a third gage hand were provided, he would not have time to watch its register slowly accumulating brake cylinder pressure. It is hard to get some to watch a five-pound reduction on black hand.

Our invitation to our readers to criticize Mr. Willett's air brake was extended witn a view of getting a more general expression of opinion than would be had from a single editorial opinion. The scheme has worked well, and we shall continue it in the future. We would say again, however, that all opinions must be friendly. Unfriendly and abusive criticisms will not be printed.—Ed.]

Willett's Reply to Criticisms on His Brake.

Editors:

In reply to the friendly criticisms of Mr. Otto Best on the Willett brake system, I will say that the quick action of the system has not as yet been thoroughly demonstrated on a sufficient number of cars to give any decided information.

The operation of this brake, as published in the June number, was taken from a test of four cars, and it operated just as it was published. It is known, however, that the reduction taken from a train line will flow just as fast towards the rear of the train in the second line as the reduction will flow from the train line to the engineer's valve, either in service or emergency application, and instead of train line air being emptied to the atmosphere, it will become efficient in applying the brakes. Train line air direct to the brake cylinders is four-fifths of the quick action, therefore all the train line air becoming efficient in applying the brakes in the duplex system I make up in the second line for the quick-acting valves; and should this not be enough?

Should the second line break, I would not lose one of my brake cylinders; or if a brake cylinder packing was gone, it would not throw me out of brakes, for the train line air would pass out of the parted second line and permit the automatic cut-off valve to close connection between brake cylinders and second line. With a leaking packing, train line air must be the first out before auxiliary air can get into the brake cylinders. When train line air is gone, the automatic cut-off valve will close and retain auxiliary air in the brake cylinders.

You say there will be many obstacles in my way to make this system work well with a long train. This is a question that is before all brake systems and it is too early yet to think we have reached perfection.

Take, for instance, twenty cars of air ahead, and twenty non-air brake cars on the rear. Part the train next to the engine, or take a train of fifty cars with the quickest automatic brake, pick them up anywhere with pistons traveling all different, and work the train well, without slack adjusters on all present systems; it cannot be done.

A. M. WILLETT.

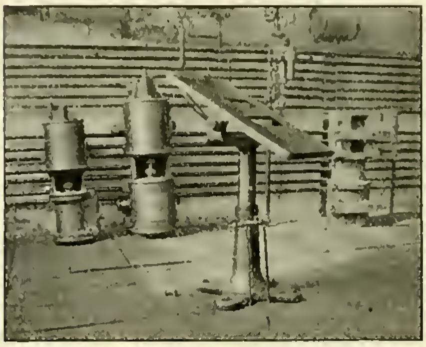
Camden, N. J.

[The above assumption that four-fifths of the quick action comes from the train line pressure going to the brake cylinder is original, even though not well founded. A service application gives 50 pounds brake cylinder pressure, and an emergency gives 60, an increase of 20 per cent. How to reconcile the last well-known figures with the others is a task we are unequal to.

The "automatic cut-off valve," as shown on page 455, June number, consists of a non-return check valve *x* with a spring and a diaphragm valve *v*. Train pipe *A* pressure holds these described parts in the upper position as shown in the picture. So long as train pipe pressure on the under side of the diaphragm valve *v* will hold the parts up against the tension of the spring on top of the non-return check valve *x*, so long will there be a communication between the brake cylinder and pipe *B*. If pipe *B* alone broke at any point, or a connecting hose on that pipe burst or be left open and uncoupled, any air sent to the brake cylinder would go to waste to the atmosphere. The brakes would be totally destroyed. If the train broke in two, and the hose couplings on both pipes *A* and *B* were separated, the "automatic cut-off valve" would not close until pressure in pipe *A* exerted less influence on parts *v* and *x* than the tension of the small spring above the latter. The triple valve, however, would respond immediately, and send air to the brake cylinder. The air would pass out by *x* to the open air until such time as the pressure in pipe *A* had reduced very low. This condition of affairs would last but a few moments, but take the oil plug out of a brake cylinder, and apply the brake full. See how long it takes to lose the greater part of the pressure.

If the drawing is a true description of the device, it will be readily seen that should pipe *B* alone be broken or uncoupled when brake was on, all brakes would release. If brakes were not on, they could not be put on, and no knowledge of the fact would be had until an attempt was made to set brakes. If pipes *A* and *B* both broke, the brakes would apply with diminished force as described. If pipe *A* alone should break, brakes would apply full force.

There is no doubt that to handle 50 air-braked cars, all having varions piston travel, is a difficult task, and requires good work. But would not a good slack adjuster be the better way out of this difficulty?—Ed.]



AIR-BRAKE ROOM, DULUTH & IRON RANGE RY., TWO HARBORS, MICH.

[Described on page 436, June Issue.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(95) A. J. M., Albany, N. Y., writes:

Should sand be dropped on the rail after the air brake is set full? If any wheels were sliding, would they be jerked loose from the shoe. A.—1. No. A.—2. No, the shoe would hold the wheel, and the sand would cut a bad flat spot.

(96) A. A. S., St. Paul, Minn., writes:

On page 577, July number, you say that the pump turned upside down only got 2 ounces more water in than the one turned right side up. Please explain. A.—The two pumps were placed in competition to determine what advantage was to be had by inverting the air and steam cylinders. The test proved, in effect, that 25 pounds and 8 ounces of the water found in each reservoir was squeezed out of the air compressor, and the 2 ounces over in the main reservoir of the upright pump leaked by the piston rod.

(97) B. E. L., Charlottesville, Va., writes:

So much has been said about the time it ought to take to charge an auxiliary reservoir, please say what is the right time. I understand that "quick-charging" triples are objectionable. Please say why. A.—1. The M. C. B. code of tests for triple valves says that with 90 pounds in main reservoir and train pipe, and the auxiliary reservoir empty, a triple should charge from zero to 70 pounds in 55 seconds, and should not charge in less than 45 seconds, nor require longer than 60 seconds. See page 155 Air-Brake Men's Proceedings of Nashville (1897) Convention. 2. The objection to quick-charging triples appears at length on page 241, Air-Brake Department, March number.

(98) J. E. R., Tamaqua, Pa., writes:

Instruction Book of 1896, in giving, on page 5, the essential parts of the improved quick-action automatic brake, says: "The fourth part is the main train or brake pipe, which leads from the main reservoir to the engineer's brake and equalizing discharge valve, and thence along the train, supplying the apparatus on each vehicle with air." I think the pipe between main reservoir and brake valve should not be called train pipe, as we have main-reservoir pressure in this pipe. It is part of main reservoir or supply pipe leading from main reservoir to brake valve. What is your idea on the subject, and oblige? A.—There seems to be some little difficulty in giving this pipe a satisfactory name. Perhaps the best name would be "supply" pipe.

(99) S. J. B., Richmond, Va., writes:

On page 120 of the Air-Brake Men's report of Nashville Convention I see the idea of a new kind of air gage suggested by Mr. C. P. Cass. He says: "The train-line pointer should stand vertical when registering 70 pounds, and the main drum pointer should stand horizontal, pointing to the right, when it showed 90 pounds. This arrangement of numerals would cause the black pointer to register 50 pounds, pointing to the left on a horizontal line, and opposite to the red hand registering 90 pounds." Would this not be all right? The positon of the hands would tell the pressure without you reading the figures, which can't be seen on half the air gages, because they are too far away or the face is not clear. A.—The scheme is a good one. Application for a patent has been made.

(100) W. C. C., Waco, Tex., writes:

Synnestvedt says the reason driver brake often releases when it should remain set is because excessive piston travel allows the slide valve to be left nearer the releasing point, as regards pressure, than is commonly the case. Should he not say "as regards position of slide valve?" A.—Mr. Synnestvedt does not say positively that such is the case. He says it seems to be, and offers the opinion as a probable cause of the action. We cannot see that either of the causes, however, suggested by him and yourself is the true one; and would rather believe that the release of the driver brake is due to either increased train-pipe pressure or decreased auxiliary reservoir pressure. We are aware that much could be said in support of the two opinions, but doubt that either could be proven to be the true cause of the action in question. Stopping a driving brake from prematurely releasing, by shortening the piston travel, or by increasing the size of the auxiliary reservoir, allows the pressure in the auxiliary to be higher when it is equalized with the cylinder pressure. This higher equalization probably places the brake beyond danger of interference of a slowly increasing train-line pressure, such as would be caused by a leaky rotary or surge of air. If either of the opinions above advanced were true, then a passenger or freight car brake, with long piston travel, would also release prematurely; but this is contrary to experience. Hence, the opinions under consideration do not seem to be well founded.

Air-Brake Items.

Read your paper as soon as you get it, and send in your correspondence early.

Slack adjusters seem to be gaining favor rapidly in the Middle Western roads.

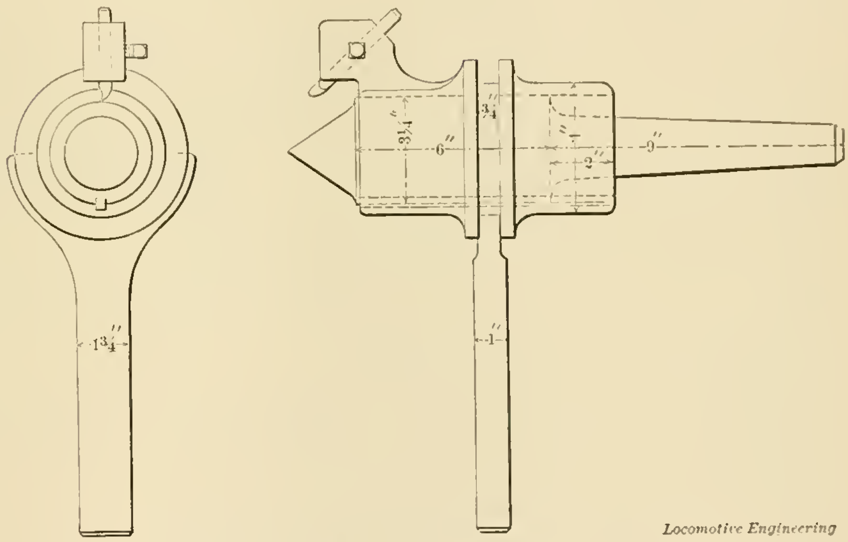
The brake shoe manufacturers seemed to be having a lively competition at the M. C. B. convention.

We hope our readers will get a thorough understanding of the High Speed Brake, illustrated and described last month. It contains some very pretty and interesting features.

The general superintendent of one of the most prominent and extensive Southern lines has issued orders that all engines passing through the shops shall have all air brake pipe and other work made to conform to the recommendations of the Air Brake Association.

Tool for Tumbling Shaft Journals.

General Foreman Place, of the Illinois Central Burnside shops, has got up a tool for turning the journals of tumbling shafts, which is a novel arrangement for its purpose, as will be seen by a reference to the illustration of it. It consists of a sleeve provided with a lug in which is secured the turning tool: the sleeve having a sliding fit on the bearing made for it by extending on the body of the lathe center a length of 6 inches beyond the tapered part. At the center of the sleeve are two shoulders that form a groove for the fork shown, which is held in the tool part and travels the length of its bearing on the center, by means of the feed screw in the regular way. In this case the work revolves against the stationary tool, the latter being prevented from any rotary motion by a key on which the sleeve freely slides. It is devised to reach and turn surfaces that cannot be brought within the scope of the ordinary tool.



TOOL FOR TUMBLING SHAFT JOURNALS.

One on the Foreman.

The foreman of the X, Y & Z Railroad was a pretty fair sort of a chap generally, but he was very quick-tempered, and when he started in to give a man a "laying out" his reason went away on a vacation and his temper had its own way while it lasted. Jack Williams had bent one of the foreman's rules; hadn't exactly broken it, but kinder warped it out of shape a little, and the foreman proceeded to give Jack a little talk that was full of high-sounding words which elevated the foreman in his own estimation. As a final blast he threatened to lay Jack off for awhile. Jack seemed half-hearted over it and said, in a meek kind of a way: "Well, you won't lay my brother off, too, will you?"

"Your brother! Didn't know you had one. Where is he?" demanded the foreman.

"Over in England, on the London & Northwestern," replied Jack.

"Well, what in hxgl have I got to do with your brother over in England," he snarled again.

"Don't know exactly," said Jack, "but I thought you must own all the railroads by the way you've been talking."

Jack wasn't laid off, and the foreman tries to be a little careful when he feels his temper rising up in his bosom like a copper float in a water tank.

Rather a novel method of preventing the annoyance from dust along railways is reported as being tried by the West Jersey & Seashore Railroad. A sprinkling car similar to that used on street railways is used, but instead of using water, the dust-destroyer is heavy petroleum oil, which is very low priced. The results are said to be highly satisfactory, and passengers are freed from the usual clouds of dust coming in at the open windows.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Box-Car Side Doors.

To ask the average railroad man interested in transportation problems the question of what constitutes a good side door for a boxcar, an answer, not at all clouded in ambiguity, would be given to the effect that a door should close tightly against rain, snow or cinders, be proof against the wiles of the hobo, and open easily to the touch of those authorized to enter the car. These requirements, it will be noted, are based entirely on commercial considerations. Ask the car man the same question, and he will tell substantially the same story, but will have an appendix treating on the difficulties to be surmounted in a practical way, in order to overcome the distortion of the door and opening due to advancing years.

This is the side from which the matter has been approached by those who, from long experience, are best fitted to produce results in accord with their own knowledge of the situation, and the inference is a natural one that the side door should have few faults for the daws on the outside to peck at. As a matter of fact, they are now, and always have been, open to improvement, and the many different designs that fail to reach the common object sought by all—that of a door to fit the known requirements—is not complimentary to the inventive genius of the car designer.

The Master Car Builders' Association will vote for adoption, as a recommended practice, side and end doors, with fittings that would appear by the light of the committee's work to be a long step in advance of former practice in door fixtures. An examination of the details, however, leads to the conviction that they stopped too soon, and ask the association to give its approval to a design that is too far from perfection to deserve the prestige of recommended practice. The reason for this belief lies in the fact that the door looks not likely to be either tight or thief-proof. If this view be correct, then the association is not ready for the question.

A full-size model of the Edgar-Sebring side door was on exhibition at Old Point Comfort, in which the features of tightness and freedom from weak points of attack from the outside were most apparent. The only objectionable thing about it coming within the range of our vision that would be likely to dim its good points was the stenciled word "patented." This door was made absolutely tight by means of a metal strip on its inside face, the strip coming in contact with the outside sheathing, and guided there by sliding on the inclined face of an angle iron which was secured to the whole length of the door post, the front end of the door abutting against the usual door stop, and held there by the casting under which the door slides. The device affords the simplest means for security that we have seen, and, in connection with the automatic lock and seal holder, commends itself at once as being a combination that deserves well at the hands of railroads looking for a tight door, and one that cannot be opened from the back.

Car Ventilation.

Dr. Chas. B. Dudley, the well-known chemist to the Pennsylvania Railroad, recently gave a very interesting lecture before the Franklin Institute on "The Ventilation of Passenger Cars on Railroads." After referring to the study which had been given to the question, he said:

"Notwithstanding the study, and notwithstanding the amount of effort and the cry that is in the technical papers, and sometimes in the daily papers, in regard to the ventilation of passenger cars, I am very sorry to have to say to you, frankly and honestly, that it is not possible at the present time to properly ventilate a passenger car on a railway. No system is at present known by which this can be successfully accomplished."

Winter and summer present different problems as the heating and ventilating systems bear a close relation to each other.

Some so-called systems merely put cold air into a car and let it find its way out as it may. Others reverse this process and provide means for drawing out the air, but no adequate means for getting a fresh supply into the car.

Calculations show that, to have perfect ventilation, 3,000 cubic feet of air per person are required every hour. With 60 people to a car, this means 180,000 cubic feet of air that must be taken into a car per hour, or the total air of car must be changed 45 times per hour.

It is practically out of the question to take this amount of air through a car per hour for several reasons, the leading ones being the amount of heat required to keep this amount of air up to the desired temperature in winter. He concludes:

"To our minds the problem of car ventilation stands now something like this. It is possible to get much more air into a car than any system now in use takes in. It is possible, if we could content ourselves with 20,000 to 30,000 or 40,000 cubic feet of air in severe weather to have such a ventilation system put on the cars today. Then in the milder weather we could increase it to the full capacity of the system. That phase of the question is being studied already quite earnestly. On the other hand, as everyone knows who knows anything about railroad matters, where there are 2,500 passenger cars requiring to be changed, it is simply ordinary business prudence to exhaust a subject pretty thoroughly and be sure of the ground before going ahead.

"I am sure I am speaking the truth when I say that railroad officers appreciate the hardship of having to sit a number of hours in a badly ventilated coach as much as the public do. I can state, from my own knowledge, that they are thoroughly interested in this subject; and I am safe in saying that the intention is to prosecute it to a successful conclusion as soon as possible."

Turning Axle Journals.

We note in one of our foreign exchanges, an item to the effect that it is the practice of some of the American car shops to turn the journals of car axles with a tool that has a cutting face accurately ground to shape, and is equal to the full length of the journal. This information comes to us solely by the above channel, and is important, if it is in accordance with the facts. We are inclined to view the statement with distrust, for the reason that any radical or noteworthy improvement in methods of removing stock would be heralded with something of a flourish by our own technical papers.

There are some few points that may be enumerated which will show the folly of any attempt to turn a car journal with a tool that will remove all the stock by the in-feed or cut-off movement, on lathes designed for cutting by a longitudinal feed. First, the average axle lathe, while constructed stiff enough and amply strong to drive a roughing cut with ⅛-inch feed against a cut ¼ inch deep, will be lamentably weak for any other method of reducing the diameter of a piece of metal, except by a succession of cuts; the forming tool cannot be used on such a lathe. Second, the particular character of the service demanded of an axle journal, makes it imperative that it should be smooth and true. That neither of these conditions can obtain by the use of the forming tool, is plain to any man that ever centered an axle, because his experience with the square-nosed tool in pursuit of a finishing cut, has made it plain that a bearing of the tool even ¼ inch wide would open all the joints in the machine and develop a chatter that would be a veritable death rattle for a journal. The reason for this is lack of support in front of the cutting tool, even if the axle is driven from the center, as in the double-end variety. The rational conclusion then is, that if a tool is used that takes in the whole length of a journal at one cut, it must be used in a stiffer and more powerful machine than has been the practice heretofore. The advantage of such a tool is not plain, since the roller produces a better surface for a journal than any other method yet devised.

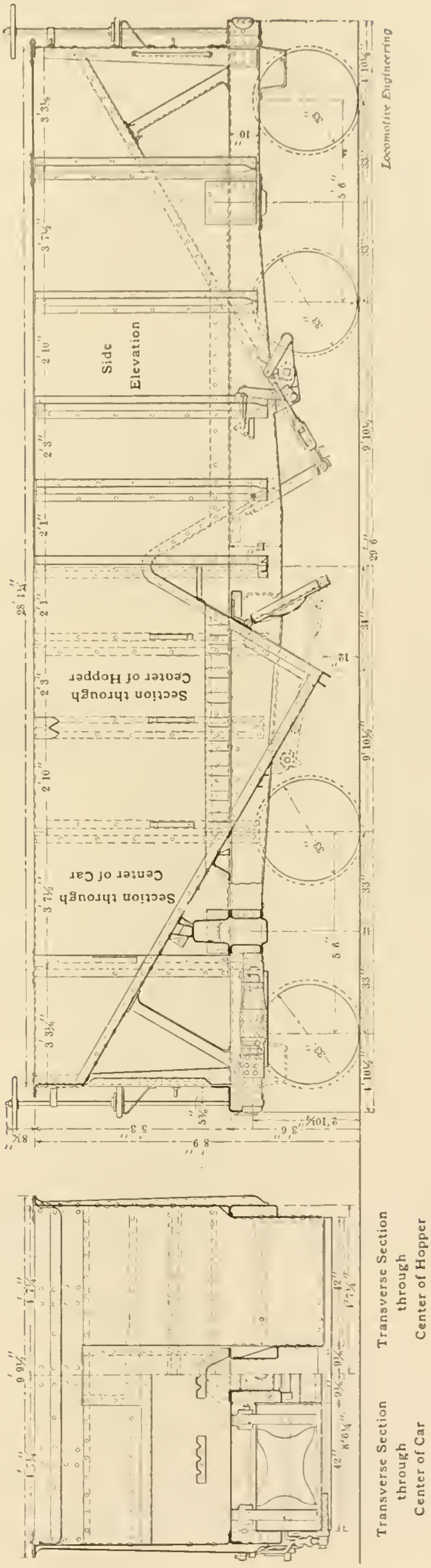
Pittsburg, Bessemer and Lake Erie Steel Car.

In our last issue was published a description of some salient points, together with a half-tone engraving of the 100,000 pound car for the above railroad. We now present to our readers the drawings of car and truck, which were not in a state of completion sufficient for our use at the time mentioned.

The engravings will convey a clearer idea of the design than can be had from a written description, showing at once all points of construction for which superiority is claimed. The long sills consist of outside and center members only, both of which are channels, the outside pair being unique in metal sill construction in being pressed to a shape previously determined by calculation to have a safe fiber stress for the load to be sustained.

Attempts have been made by some other builders to produce a sill deep at the center and shallow at the ends—the theoretically correct shape—by a union of two or more parts; but it has remained for the Schoen Company to reach results in the single piece construction, 17 inches deep at the center and tapering to the bolsters, from which point out they are 10 inches deep. The center sills are plain 10-inch channels placed 8 inches apart with the flanges outside.

The service for which these cars are intended has made it possible to introduce a bolster at once of the highest type of efficiency and a wide divergence from former practice for that important member. It is made U-shaped—pressed, of course—11 inches deep at the center and 4¾ inches deep at the ends. The solid side is placed up, thus bringing the straight and open side at the bottom. The inclined ends of the car afford the best of opportunities for a proper depth of bolster at the center to resist any bending moment, and full advantage is taken of the opening to do so. The bolster is placed on the top of the sills, and being inverted, allows the car to be brought to any hight desired, and the inclined ends are also furnished a good bearing on the top of the bolster at a point where support is needed. There are many interesting points about these bolsters that will be certain to receive the attention of those who have wrestled with the bolster problem. The absence of truss rods is the best evidence that the car is a



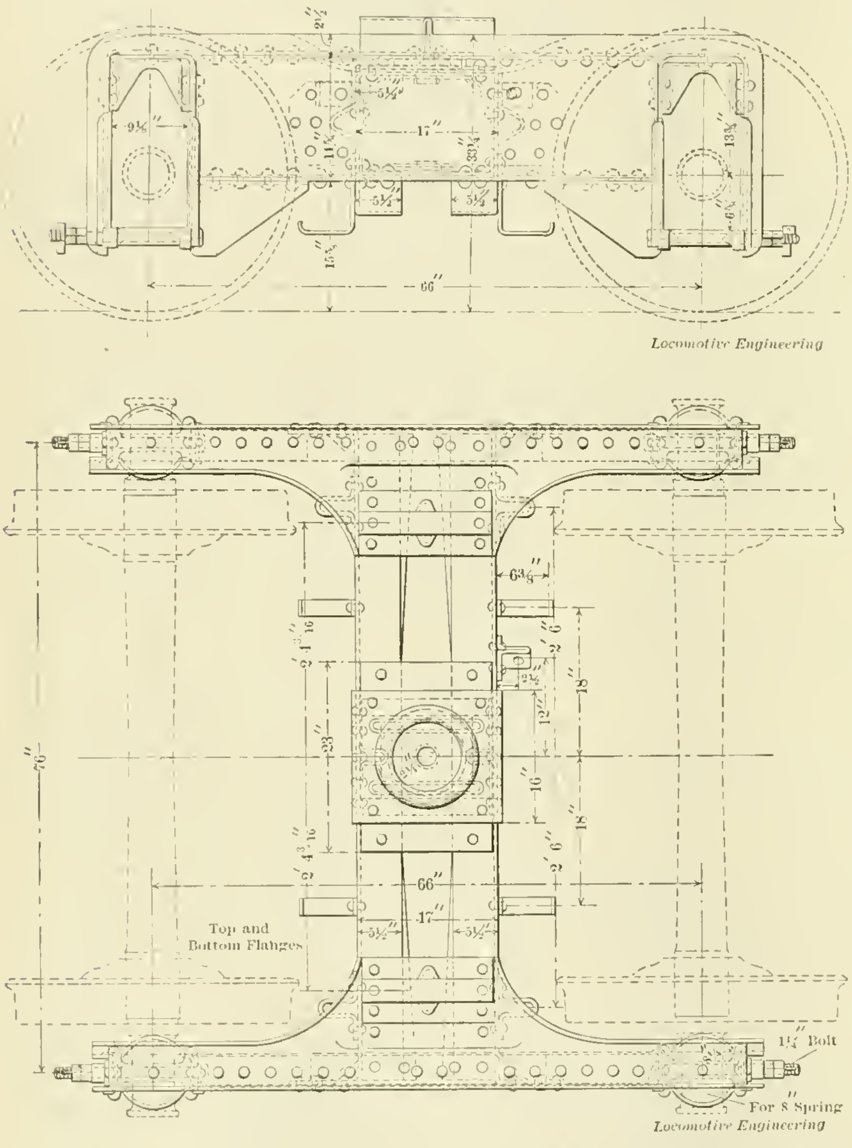
PITTSBURG, BESSEMER & LAKE ERIE STEEL 100,000-POUND CAR.

strong one, and that the material has been put where it belongs.

There may be said to be hardly a piece in this car that has not been pressed to shape. Commercial rolled sections have not been considered as to adaptability for use. All parts have been designed to perform a certain function, and brought to the shape that would best give the results sought, strength and lightness always being the first consideration. A study of the engravings will make this perfectly clear.

A side elevation and plan of the truck gives a good idea of the disposition of metal in it. One of the first things to strike the observer is the provision for taking up lost motion in the jaws by means of shoes which are easily shimmed, detached or replaced. Such an arrangement should make its influence felt in preserving a truck's square lines. Rigid, and with inside brakes, it has a new and modern appearance, thoroughly in keeping with the car it sustains. Taken as a whole, the car and truck shows an independence of thought that must excite the respect of those engaged on kindred lines of how best to utilize steel in car construction.

The Utica Steam Gage Company have issued a very artistically got up illustrated catalog, showing their various forms of pressure gages, revolution counters and other steam-engine attachments made by the company. Men who are connected with the ordering of pressure gages will find this catalog a very useful reference.



SCHOEN TRUCK, PITTSBURG, BESSEMER & LAKE ERIE STREET CAR.

Notes of Master Mechanics' Convention.

(Continued from page 581.)

When the report on counterbalancing was presented, Mr. Sprague's motion that it be received was carried, and Mr. Henderson expressed himself as pleased that last year's proposed practice was still in force, the second clause of which recommends the distribution of the remainder of the weight equally among all driving wheels on one side, adding to it the weight of the revolving parts for each wheel on that side.

Exception was taken by Mr. Leeds to a distribution of the weight by the manufacturers in the manner referred to above, and he gave instances of bent rails, from which he concluded that it was dangerous to place any more counterbalance in the front and back wheels of consolidation engines than was absolutely necessary. In the case of these engines the main wheels were left from 100 to 150 pounds light. Mr. Henderson did not advocate sufficient counterbalance to damage the rail. The balance should not exceed a safe weight on the rail. If it was impossible to get the proper amount of counterbalance in the main wheel, he did not see that there was any objection in distributing it among the other wheels, provided the rails were not overloaded.

Mr. Forsyth stated that counterbalancing, as far as it relates to riding of the engine, is no longer difficult; the question is the maximum allowable weight on the rail, and what is the maximum stress in the rail. The total pressure is the static weight on drivers plus the centrifugal force. Some of his engines showed that, with speeds as low as 50 miles an hour, there was a load of 20,000 pounds per wheel, and at 60 miles an hour there was 22,000 pounds in the wheel. He thought that we had now reached a point where we ought to have the assistance of the American Society of Civil Engineers, as well as the rail manufacturers, in giving us some information as to what maximum stress is allowable in different rail sections.

The apprentice-boy question having been aired sufficiently in the twelve months since the last meeting, the subject was ripe for earnest discussion by the members. Mr. Vauclain explained that there were a number of manufacturing establishments which were giving serious attention to the matter, and formulating a series of indenture papers, similar to, but better than those in vogue in years gone by. He proposed that action be put off until more data could be collected, when the question could be discussed in a more able manner than at this time. The system followed in the works presided over by the speaker was presented in a few words.

The findings and recommendations of this report were of the most creditable and exhaustive character, they embodying not only a practice formulated by the committee for handling the apprentice problem, but gave a schedule devised by the Norfolk & Western Railroad, and in use on that road with the greatest good to both employer and apprentice.

One of the most important of the subjects before the convention was that of ratios of grate area, heating surface and cylinder volume, and the report on it was of greatest interest and value. There was but one portion of it that was in the least vague, and that was the paragraph referring to reliable data on the relative value of firebox and tube-heating surface; some investigators claiming that the firebox was twice better, and some ten times that of the tubes as heating surface. From the lack of thorough information in this particular, it is not clear to us why some effort is not made to get facts that can be of use to an association engaged in the compiling of data for the correct design of the future locomotive.

In the matter of locomotive grates, there is the same difference of opinion existing as heretofore, which was shown by a very long, but clean and concise report.

Piston valves for simple locomotives were thought to be a good thing by Mr. Forsyth, if properly designed, although there is a difficulty in setting them, on account of its not being easy to fix the port lines.

Water as a lubricant was known by Mr. Mitchell to be used on the journals of an engine for a period of three months, and that without the least trouble. He thought it the correct thing to use water on bearing surfaces which are liable to run hot. Mr. Gillis had known a locomotive to run two months with nothing on the drivers but water. He had cellars to his boxes, but did not rely on the oil supplied to them during that time.

On the subject of manual versus automatic control of compounds, Mr. Soule said that, as he understood, compound locomotives of every kind had some sort of manual control. In the Vauclain type the change is effected manually. In other forms of compounds the change is entirely automatic. He favored the manual control, for the reason that he was familiar with that form and had little knowledge of the other kind. Mr. Querean said that two years ago there was published the results of fuel records of two engines, one of which could be converted into a simple engine at will, and other could not. The one that could be converted into a simple engine showed the best fuel economy because it could haul heavier loads.

About the causes of irregular cylinder wear, Mr. Brown said that he found the wear on top of cylinders, though some contend that it is on the bottom; the wear begins about 1½ or 2 inches from the end of the stroke, and decreases toward the middle. The bull rings and piston rings show no evidence of coming in contact with the wall of the cylinder at all; but there is plain evidence when boring out the cylinder and taking out what would be thought enough to true up the wear, it would be found that the top of the bore was worn more than the bottom. Mr. West stated that he had the same trials with bushed cylinders, but in the abandonment of the solid piston with the snap rings, the wear was overcome. With alligator crosshead and sectional packing, there was no trouble, with the same character of iron.

Mr. Lawes opened the discussion on broken staybolts by reciting his experience in detecting those that were partially broken. His investigations gave ample proof of the inability of the best talent among inspectors, to locate, by the hammer test, a bolt that was partially broken. The tests made furnished convincing proof that cracked staybolts cannot be detected by the hammer, and there was no doubt that a great risk was run by either not drilling the ends, or not using hollow staybolts, and that either of these precautions will prevent many boiler explosions. The expense of adoption of these safeguards for the prevention of boiler explosions is simply an apparent one, the cost of drilling being about $3.75 for a firebox containing 900 staybolts.

Mr. Vauclain gave some entertaining facts concerning the best metal for locomotive cylinders, all of which were the results of his efforts in the direction of systematically recording all observations of mixtures and proportions of everything that went into the cupola, together with the chemical, physicial and abrasive tests. In the latter case, a cylindrical piece ⅝ inch in diameter and one inch high, was turned from the broken tension tests, and this was carefully weighed and the weight noted after the test, which consisted of weighting the cylinder and abrading it by rubbing in contact with a hardened steel die. The results given by this process showed that up to 28,000 pounds weight, the wear decreases rapidly as the tensile strength increases, the best wearing material ranged in tensile strength from 28,000 to 32,000 pounds per square inch, but within these limits a given increase in strength did not show a proportionate increase in wearing qualities.

A great deal of light was flashed on the average member, and particularly those not up in foundry lore, by that part of the discourse referring to the chemical properties of cast iron, in which the information was disseminated that there are more misconceptions concerning sulphur than any other element. Any defects that are discovered are invariably attributed to sulphur. It was found in these investigations, that an iron was undesirable for use in cylinders, unless it contains a minimum of .07 per cent., and that it is really beneficial up to .12 per cent. The difficulties of getting a perfect casting from such a complicated mold as a locomotive cylinder, increases when the sulphur runs above .15 per cent., and the tendency to crack is also greater. A large proportion of the sulphur in cast iron is derived from the fuel, so that to keep this element within bounds, it is really more essential to watch the coke and working of the cupola, than the pig iron. In general, sulphur increases the tensile strength by increasing the solubility of the graphite in the iron, though the data are not yet formulated so as to give quantitative figures. Silicon it is well-known acts as a softener, and it is aimed to secure silicon from 1.3 per cent., to 1.7 per cent., in cylinder mixtures. Phosphorus and manganese both act as hardeners, and if present in too large amounts, make the iron brittle; they both tend to give the finished casting a good clean bright color, and when below .8 per cent., can do no harm. Our experience, Mr. Vauclain continued, has been chiefly with low manganese irons, for during the melting process, the principal part of the manganese seemed to become oxidized so that the casting rarely contained more than .4 per cent. We therefore aim to have our cylinder mixtures conform to the following specification: Tensile strength, 27,000 to 33,000 pounds. Combined carbon, about .6 per cent. Manganese, about .35 per cent. Phosphorus, .6 to .9 per cent. Sulphur, .07 to .12 per cent.

These brief excerpts from the proceedings contain all the evidence necessary to show the educational character of the business transactions of the conventions of the association, as well as the high order of talent brought out in the consideration of the momentous questions of locomotive engineering. The members have returned to their homes with the consciousness of a duty well done.

We are informed that the trains running on the Philadelphia & Reading, which make such tremendous fast time between Philadelphia and Atlantic City, have Ajax metal bearings on engine and passenger cars.

Lengthening the Chinese Railways.

Another 40 miles has been added to the Imperial Railway, making about 214 miles now completed and ready for business. The line from Tientsin to Pekin is nearly completed, and this will add another 80 miles to the length of the road. John Chinaman was a little slow in adopting railroads, but he seems to be hustling to make up for lost time.

A Strong Argument.

A railway employé, whose home is in the country, applied to his superior for a pass to visit his family.

"You are in the employ of the company?" inquired the gentleman alluded to.

"Yes."

"You receive your pay regularly?"

"Yes."

"Well, now suppose you were working for a farmer instead of the company, would you expect your employer to take his horse every Saturday night and carry you home?"

"No," said the man, promptly, "I would not expect that. But if the farmer had his horses out, and was going my way, I should call him a mean fellow if he would not let me ride."

The employé came out three minutes later with a pass good for twelve months.

The United States Court of Appeals has rendered a decision that the Michigan Lubricator Company's locomotive sight lubricator does not infringe the Craig patent sight-feed lubricator.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(54) J. H. H., El Verano, Cal., writes:

I find on your educational chart, the transparent picture of engine 999, that the eccentrics are shown, one exactly opposite the crank pin and the other between the crank pin and the axle; while to the best authority I have (see page 318, April issue, 1896), they are placed at right angles to the crank-pin. Will you please set me right? A.—The eccentrics on our transparent chart are in the position you name, and are therefore not correct with reference to the crank pin. They were placed as shown after much deliberation, in order to clearly show all the parts possible, it being considered better to sacrifice accuracy of position rather than omit any lines. You are mistaken, however, about the eccentrics being placed at right angles to the pin in our article, "Angular Advance," referred to above, as it was the special purpose of that article to remove the stumbling block of the "right angle" theory from the path of the beginner. Read it again.

(55) G. H. M., Hewins, Kan., writes:

I had an argument with a young engineer about what causes the oil to flow from the lubricator. Is it the pressure of the steam, which is my claim; or is it the weight of the condenser water, which is heavier than the oil, that causes the latter to flow from the lubricator with an equalized pressure, as my friend claims? A.—It is the steam pressure in the condenser of the lubricator that causes the oil to flow to the cylinders. This pressure must be greater than that on the steam-chest side, or feed cannot occur, and in recognition of this fact, the Nathan Manufacturing Company, of New York, have devised an attachment for the lubricator that automatically provides for a greater pressure on the lubricator end of the oil pipe than on the steam-chest end. This is done by utilizing the steam-chest pressure, which, when it is great enough to check the flow of oil from the lubricator, will open a valve and allow the steam-chest pressure to come on the choke plug from the same side as the lubricator pressure, and the additional volume of steam thus forces the oil continuously into the steam chest when the throttle is open.

(56) C. F. C., Hartford, N. Y., asks:

What was the object of inclining cylinders which are in use on some of the old style and odd makes of engines? I have run a Porter light locomotive with the above arrangement of cylinders, and thought it had a tendency to increase the up and down or rocking motion of the engine, which was very bad to ride on, and the piston would strike hard against the cylinder heads at frequent intervals. A.—Builders placed their cylinders at an inclination for the purpose of having the longitudinal axis of the cylinder in line with the center of the main driving axle, when from any structural reasons the cylinders could not be placed in a horizontal position without having these center lines too far apart in a vertical plane. The rocking motion can properly be attributed to the absence of the steadying influence of an engine truck, as most of the engines of the kind referred to above do not have a truck at the front. The overreach of the pistons is an ordinary occurrence on rough track, and the pistons are quite certain to strike the cylinder heads if there is not sufficient clearance at each end, or the rods are too long or too short; this will occur with cylinders whether inclined or horizontal.

(57) H. L. C., Centralia, Ill., asks:

1. Would a tank of water situated, say, 20 feet above the ground, be emptied quicker if a 1-inch pipe was put in the bottom leading perpendicularly to within say, three feet of the ground, than if allowed to run out of a hole the same size as the inside diameter of the pipe, without a pipe being attached. A.—If a 2-inch pipe is put in, having an orifice at the bottom one inch in diameter, the discharge would be quicker, as the friction would be less, and would not overcome the increased head. If the pipe were one inch in diameter, the same result would be expected, although the frictional resistance of the pipe might lead to different results, especially if the tank were shallow; so that the pressure at the entrance of the pipe was not sufficient to supply the discharge capacity of the pipe; and again if the tank were deep, the discharge would probably be greater with the pipe, but as the water was lowered the pipe would be starved, so to speak, in consequence of the pressure of the water at the entrance of the pipe not being sufficient to supply the discharge capacity of the pipe. 2. Would a water motor run freer if a pipe was placed so as to run the waste water perpendicularly into the sewer, than if allowed to exhaust directly into said sewer, the sewer being practically empty; or, in other words, does the action of the water being confined in a pipe cause it to run quicker than if allowed to fall into the air? A.—In the light of the foregoing, the motor would run freer with the pipe than without, but it must be borne in mind that experiment is productive of better results than theorizing, especially in the matter of hydraulics.

(58) C. B. G., Harrisburg, Pa., writes: We would be glad to have your decision in "Locomotive Engineering" on following questions: 1. In endeavoring to increase the diameter of locomotive driving wheels by shrinking new tires on top of the old ones after the latter have been nicely trued off, would there be any liability of the engine not riding as good as before, or would it be likely to have a bad effect on the engine in this or any other way? A.—No harmful complications have ensued from this method of enlarging driving wheels in the very extensive practice of it within our knowledge. It is largely employed as a remedy for the small wheel evil. 2. In speaking of the question of heating houses by the hot water system, A says that in heating the water at the boiler or furnace, it gradually becomes warm from the lowest to the highest point by the heat traveling through the water until the whole has become heated. B claims that as soon as the water becomes warm at the boiler, it commences to move and continues in motion from the boiler to the highest point in the system all the time, thereby making a continual movement or circulation so long as fire is in the furnace, and that the whole body of water in the entire system is constantly in motion. Which is right? A.—The theory of heat gradually warming a body of water from the lowest to the highest point is that of conduction, and since water is a poor conductor it is plain that some other system should be used. The position taken by B is based on the principle of convection, in which the warmed lower part of the water loses a portion of its density, and rises toward the higher surface, while the colder and denser upper layers of water descend: this action creating a circulation; therefore B is right.

(59) C. S. J., Portsmouth, Va., asks:

1. What position is best to take down main rods in order to file the brasses? A.—Any position that will allow a supporting block to be placed under the back end of the rod. 2. How can I tell how much to take off each half of brass? A.—Calliper the journal at the largest place, and divide the total amount that the brasses must be reduced, between the two halves of the brass. 3. What size and kind of file will it be necessary to use? A.—This will depend on the amount of metal to be removed. In general, a 14-inch bastard file will answer all requirements. 4. How must I hold and manage the file when filing a brass? A.—Seize the file so that the handle is held in an easy grasp with the thumb resting on top; place the palm of the other hand on top of the file at the end, with the fingers lightly grasping the file, and the thumb towards the body. Push the file as straight as possible, while bearing on it with an even pressure the full length of the cutting stroke, and raise it slightly on the return stroke. 5. What is a fillet on a pin? A.—It is the curved surface at the junction of the collars and journal. 6. How can I tell about what liners to use in each strap? A.—By noting the

space between brass and strap and the brass and rod butt when the key is up to its extreme hight; the liners should be so disposed at each end of brass as to maintain proper length of rod. 7. What material should I use to grind in a leaking check valve? A.—Grindstone grit or powder is good for brass work. Read "Locomotive Running Repairs," by Hitchcock. 8. What is a "dutchman"? A.—It is a shop name given to a piece of metal placed so as to fill a space left by ill-fitting parts. Your remaining questions can be answered by the exercise of your mental machinery.

(60) H. O. W., Alexandria, Va., asks:

Will you please tell me in your paper, first, which is the proper way to fit a driving box? A.—In the absence of any positive information as to the part of the driving box involved in the question, we will assume that it is the fit of the brass on the journal; if such is the base of the query, the proper way to make the fit, is to first bore the box so that it will caliper a metal and metal fit. This will leave the box tight on the journal after the brass has been eased off at the point below the diameter or calipering place on the brass, so as to pass over the journal. The brass is then scraped to a fit on the journal by making the sides just touch and the crown of the brass just clear. The object of this method of fitting the brass closer at the sides than at the crown, is to be sure of a side contact when the engine is jacked down on the boxes. 2. Which is the proper way to fit truck brasses? A.—The common practice for truck brasses is directly contrary to that for driving boxes, they being made to bear on the crown only, and this is carried, in some cases, to the extreme of making the bearing on one or two strips of brass or other anti-friction metal, which are let into the crown of the box. 3. What are some of the causes of driving boxes and truck boxes running hot? A.—The heating of driving brasses may be attributed to many causes, like improper fitting, an insufficient lateral play between box and wheel hub, seamy journals, journals so small as to impose too great a weight per unit of bearing surface, bad tramming, and lack of lubrication, or any combination of the above. These are some of the known causes; the unknown reasons are probably fully as numerous, since a box will sometimes run hot when by all the tokens the opposite condition should prevail. The cause for a hot truck box can almost always be traced to the lack of contact between the journal and packing, due to cellar dropping away from its proper position, or bunching of the waste in the cellar. Ordinary care in keeping dirt away from the journal and oil on it, rather than any care in fitting of the brass to the journal, is the requisite for cool running of a truck brass.

Additional Equipment Notes.

The Live Poultry Transportation Company are having 39 freight cars built by the Terre Haute Car & Mfg. Company.

The Canadian Pacific Railway are building 400 standard box cars of 30 tons capacity at the shops at Perth, Ont. They are also building 100 refrigerator cars at the same place.

Davies Bros. & Hartman are buiding for the Bethlehem Iron Company ten end dump cinder cars, ten tons capacity, and one of seventeen tons capacity for the Maryland Steel Company.

The Richmond Locomotive Works have received orders from the Galveston, Houston & Henderson Railroad for two 19-inch switching locomotives; and from the Louisville & Nashville Railroad orders for ten 21-inch consolidation locomotives.

There are not many 16-inch cylinder ten-wheelers being built nowadays. The Keokuk & Western have, however, just received three new ten-wheel engines from the Rogers Works, having 16-inch cylinders, and carry 180 pounds pressure. Their idea is to favor the track. These are standard gage engines.

The Schenectady Locomotive Works are building three twelve-wheel or "Mastodon" compound locomotives for the Butte, Anaconda & Pacific Railroad. These engines are the largest of this type ever constructed, the cylinders being 23 in. and 34 in. in diameter, with 32 in. stroke; driving wheels 56 in. in diameter; weight of engine in working order, about 189,000 lbs.; boilers are of the extended wagon top, radial stayed type, with about 3,000 square feet of heating surface, and will be built to carry 200 pounds working pressure. The engines have cast steel driving wheel centers, and both cast and pressed steel are used very largely in their construction.

The Union Tank Line has taken a firm hold on time's forelock, and will cross the tape with the leaders in the hustle for automatic couplers and air brakes. They are working their Chicago, Buffalo, Cleveland and Lima shops night and day, so that there will be no mistake about their 8,000 cars being in shape by January 1, 1898. Seven hundred cars have been scrapped during the year, for various causes, the principal of which is the gnawing tooth of age on the bodies. The tanks are preserved for future use, as are also wheels and axles that are within condemnation limits.

The Michigan Central uses up its scrap front-end netting by lining the under side of the deflecting plate with it, and also putting a piece of it before the front-end door. It kills cinders.

The Locomotives Shown In Our Historical Chart No. 8.

The little engine shown boxed in with an iron cab in our locomotive chart, has a history of its own. It was the first locomotive to run on the New York Elevated Railroad, which ran at first from the Battery to Ninth avenue only, by way of Greenwich street, and had a wire cable for power to haul the cars. This process of handling passengers was not a successful one, and at the suggestion of Mr. D. W. Wyman, who was the superintendent, this little engine was built.

On the original builder's plate an inscription told that the engine was built by Handren & Ripley, Albany Street Iron Works, New York, 1871; designed by D. W. Wyman. The cylinders are 6 inches diameter and 8 inches stroke, set vertically at one end of the frame and geared to one pair of driving wheels, from which side rods take the other pair.

The boiler is of the vertical tubular type, about 3 feet diameter by 6 feet high. This engine served its purpose for a short time, and, upon the extension of the line, was sold to the West Point Foundry Company, where it is in service to-day, hauling material about the yard.

Not second in interest to the first elevated locomotive, is the double-ender designed in 1867 by Mr. William S. Hudson, superintendent of the Rogers Locomotive Works. This was really the originator of the modern suburban engine, although the Forney, which was designed later, soon became the leading favorite for handling light suburban train. The Forney of 1885, built for the Brooklyn elevated, shows the full development of that type of engine. The Brooks 6-wheel connected suburban engine, built in 1893, may be taken as most perfect development of the Hudson engine.

"The World's Railway" is meeting with a very favorable reception from railroad officers and others interested in the history of railways. We have received many letters expressing unstinted praise for the beauty of the book. A very good percentage of the orders received for "The World's Railway" is from abroad.

By a concession of the Mexican government, Messrs Alfred A. Spendlove and E. C. Creel expect to construct a railroad from Chihuahua directly west to the Pacific coast. A time limit is set for the beginning and completion of the work, and all plans must be submitted to the Department of Communications for approval. The road must be completed by April 13th, 1904. This is mostly to assist the development of the mines in the neighborhood of Chihuahua and the government will grant subsidies for a portion of the line.

The Rue Manufacturing Co., makers of the Little Giant and other injectors, have removed their office from 116 North Ninth street, to 215 Race street, Philadelphia, Pa. This places their office and works together, and will facilitate getting out both new and repair work.

A railroad man is not well posted nowadays unless he knows all about station signals. The easiest way to acquire full and exact knowledge of this subject is to study carefully Elliott's book on Block and Interlocking Signals, which is sold in this office for the modest sum of $3. It is profusely illustrated, and tells by print and picture what signals are; what they do; and how they do it. Everything told in plain English. No soul-racking study needed to understand any part of the book.

We have received, within the month, two of the "Four Track" series of folders sent out by Mr. George H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, for the purpose of telling people about the wonderful attractions of the New York Central Railroad. One of the folders treats of "America's Great Resorts," and the other "Suburban Homes." Both folders are particularly attractive, and show, by maps and half-tone engravings, many attractive scenes on the line of the New York Central. Either of these folders can be obtained from Mr. Geo. H. Daniels on the receipt of two 2-cent stamps.

The Burlington route have put on a superb, luxuriously furnished train, which they call the finest in the world, that is making the time between Chicago and Minneapolis in 13 hours and 55 minutes. All the cars have steel platforms and wide vestibules. The interior finish is in vermilion wood, with decorations in royal blue, excepting that in the compartment sleeping car. Each state room is differently upholstered and decorated. The state rooms all contain every sanitary convenience, and are supplied with hot and cold water.

Mr. George F. Hinken, secretary and treasurer of the National Railroad Master Blacksmiths' Association, has sent out a circular advising members that the next convention will be held at Chicago, commencing September 7, 1897. The Leland Hotel will be the headquarters of the association. This association is undoubtedly performing valuable services to railroad companies, and also in spreading information concerning blacksmithing among the members. It deserves to be well supported, and we should advise every foreman of a railroad blacksmith shop to join it.

We have received Catalog No. 9 of the Clayton air compressors. It is profusely illustrated with good engravings, which show a great many purposes to which compressed air is applied. The various air compressors made by the company are illustrated and described in a very lucid style. Parties interested in the use of compressed air will find this catalog a very useful reference.

The Buffalo Forge Company have issued a very neat illustrated catalog, showing the various articles made by the company and describing their use. The catalog constitutes an admirable handbook on mechanical draft fans and apparatus. It contains a mass of information about fans and blowers that cannot be found elsewhere.

We have received Part 5 of Easy Lessons in Mechanical Drawing & Machine Designing, by J. G. A. Meyer. This number is quite as good as any of its predecessors, and shows satisfactory progress in the science of machine designing. It is published by the Arnold Publishing House, 16 Thomas street, New York.

People who are looking for a summer location should send to Mr. D. J. Flanders, general passenger and ticket agent of the Boston & Maine, at Boston, for a copy of "Lakes and Streams." This is a handsomely illustrated catalog, and shows a few of the attractive spots to be found on the Boston & Maine Railroad.

We are informed by the Sams Automatic Coupler Company, that their coupler is making steady headway into favor with railroads in the West. The Rio Grande Western have discarded all their couplers and are equipping their cars with the Sams.

The Baltimore & Ohio Railroad people are making a great many improvements of a permanent character to track and road bed. Among important works recently finished was the straightening out of a curve, which was done at an expense of nearly $100,000.

Engine No. 1,027, of the Reading Railroad, Atlantic City division, is reported to have pulled six cars, weighing 370,000 pounds, from Camden to Atlantic City (55½ miles), in 47½ minutes. The speed in places is given as being 85 miles per hour.

Bement, Miles & Co., of Philadelphia, have recently furnished to the Lake Shore & Michigan Southern a special 3,300-pound steam hammer. The hammer was designed to meet special requirements given by Mr. G. W. Stevens, superintendent of motive power, and is intended for miscellaneous forging, including high work, such as welding pedestal jaws on locomotive frames. It is a very convenient hammer, and we anticipate that a good many railroad shops will want hammers of the same pattern.

The D. & C. Steamship Line.

At this time of the year the question, "Where will you spend your vacation?" becomes a general and an important one. Many people find spending their leisure days in one place monotonous, and prefer a trip through attractive scenery, where they may spend a day here or there, as the fancy of the moment may dictate.

The "D. & C." line of steamships offers unusual advantages for such a vacation; the service is good and the boats commodious and comfortable. They run from Cleveland, Toledo and Detroit to Mackinac Island and St. Ignace, touching at beautiful little places all along the Michigan shore of Lake Huron.

Fish and game are plentiful through this part of the country, and the temperature is generally delightfully cool. Another desirable feature is that the trip is not an expensive one.

Descriptive pamphlets, with maps, rates, etc., can be obtained from ticket offices or from the company's office, Detroit, Mich.

The Roller Bearing.

In machine-shop economy there is as much to be gained by the use of the roller bearing as by any other device within our knowledge at this time, if we give credence to the well backed and unsolicited testimonials in its behalf by parties who, actuated by a spirit of fairness, come forward with results that can but be flattering to the device.

As built by the Mossberg & Granville Company, of Providence, R. I., there is practically no limit to the applications of the roller bearing in all shops, and if the claims for it are half borne out, there will be power to give away in every shop where it is installed, as has been the case in the plants now using it. Roller bearings have passed the experimental stage, and are now being pushed as one of the necessities of the hour by live manufacturers, who guarantee a saving of from 25 to 75 per cent. of the power required without their use. The confidence inspired by such a guaranty should be productive of lasting results in shops that are chronic sufferers from lack of power.

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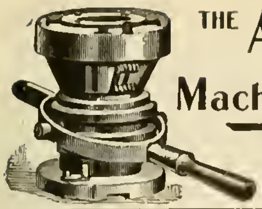

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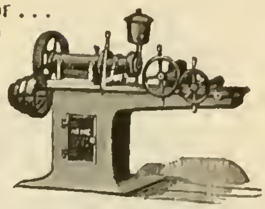

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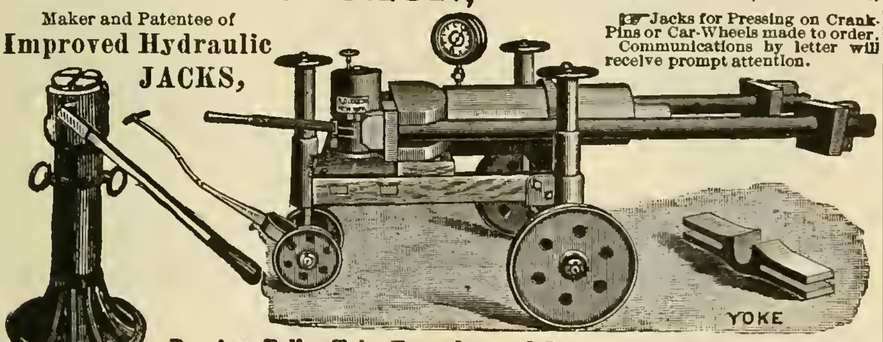

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(*Continued on page 656.*)

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Proceedings of Fourth Annual Convention, Association of Railroad Air-Brake Men. 1897. This was the last meeting of this association at Nashville, Tenn., and contains the latest information on the air brake, lots of kinks that cannot be found elsewhere. There are 240 pages 6 x 9 inches. Embossed paper cover, 50c.; leather.. .75c.

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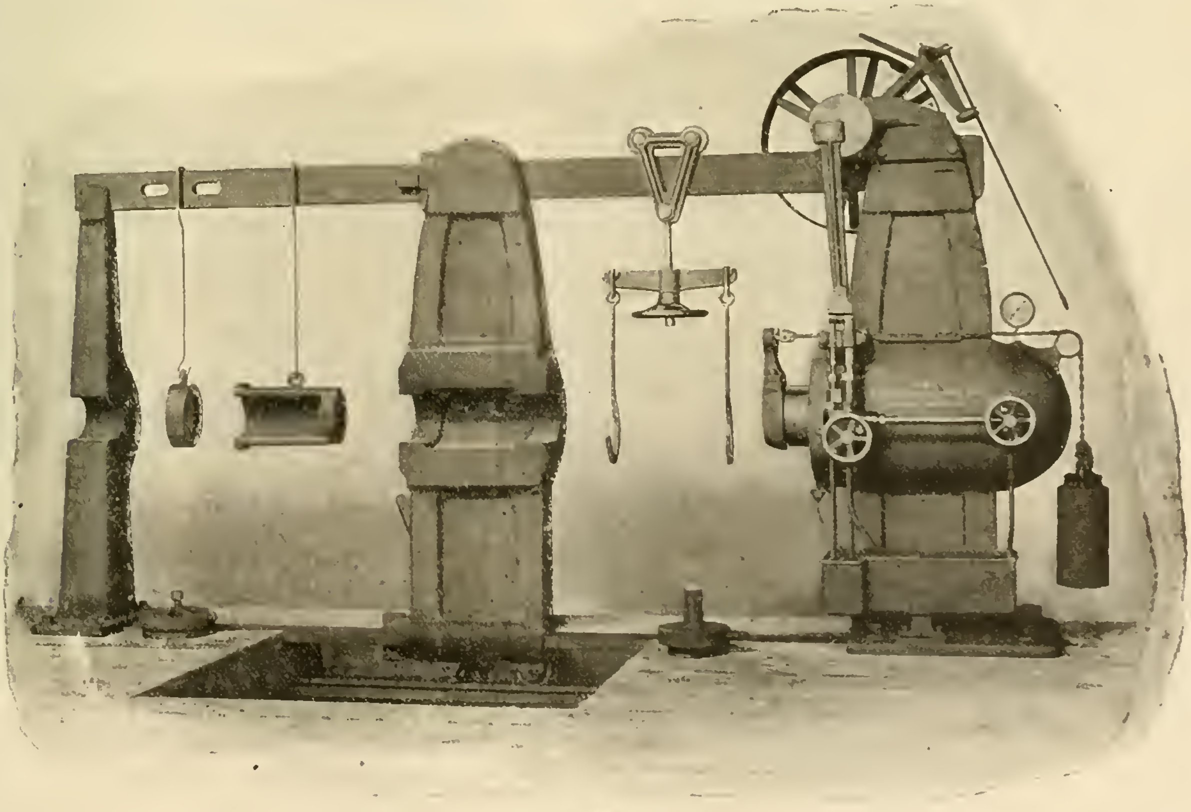

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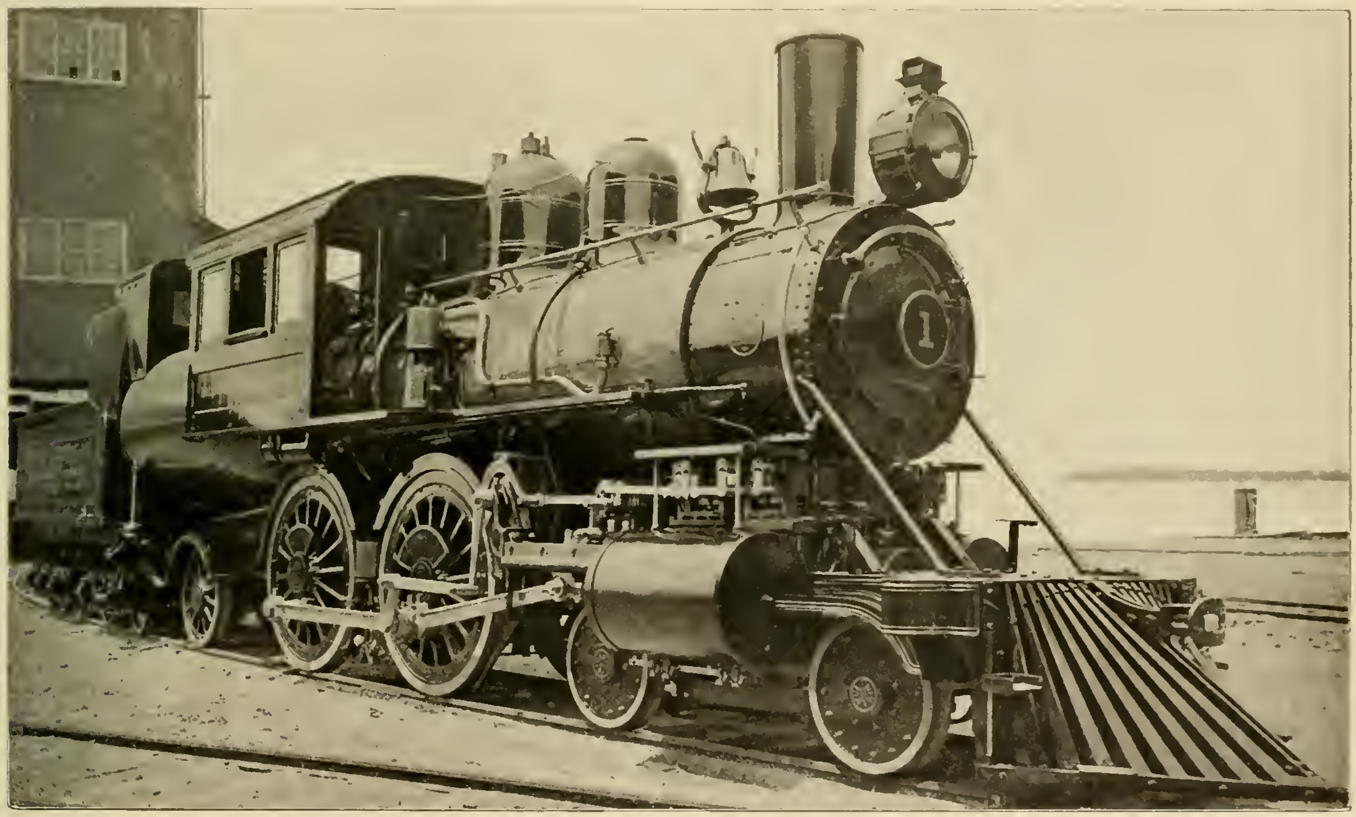
LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. X. NEW YORK, SEPTEMBER, 1897. No. 9.

A Perfectly Balanced Locomotive.

We mentioned some time ago that a four cylinder compound locomotive, designed by Mr. George S. Strong, was undergoing tests at the mechanical laboratory of the Purdue University to demonstrate the general efficiency of the engine and to indicate to what extent the designer had succeeded in producing a locomotive with the driving wheels so balanced that there would be a minimum of shock transmitted to the rails.



A PERFECTLY BALANCED LOCOMOTIVE.

The locomotive, as it appears in working order, is shown in the annexed engraving for which we are indebted to the "Railway Age."

The engine differs in several respects from ordinary locomotives and embraces a variety of features introduced by Mr. Strong in several simple locomotives built a few years ago and which were well known to our readers at the time. Apart from the compound and balancing features of this engine, which are peculiar in themselves, the valve motion and the firebox are wide departures from the ordinary standard. The valves, which are of the gridiron type, with separate exhaust valves, are operated by a radial motion of a rather simple character. Instead of a firebox there are two corrugated flues that make a joint furnace.

The most interesting feature of the engine, of course, is the arrangement of the cylinders and their connections. The two high-pressure cylinders are located between the frames under the smoke box and transmit the power through a crank axle. The low-pressure cylinders are outside the frames in the position of the cylinders by an ordinary simple locomotive, and which are connected outside in the ordinary manner. The cranks are so arranged that the inside crank pin is diametrically opposite to the outside crank pin on the same side. By this arrangement, all the revolving parts are balanced by revolving weights and all the reciprocating parts by reciprocating weights. The rear wheel has only revolving parts connected with the crank pin and the counterbalance in this wheel is made sufficient for these parts alone. As there is no excess balance in this wheel, the condition of perfect equilibrium is maintained undisturbed. While the conditions affecting the main wheel are somewhat more complicated, they are quite as perfectly dealt with. The revolving parts attached to the outside crank pins are perfectly balanced by the revolving counterbalance in the wheel, and the reciprocating parts attached to this crank pin have absolutely no balance in the wheel. The revolving parts attached to the inside crank are perfectly balanced by revolving parts attached to these cranks. The reciprocating parts connected with the inside cranks have no balance in the wheel, i. e., the revolving parts attached to the crank pins are in each case balanced by revolving counterweights, which enter into the design of the wheels and cranks. The main wheel has no excess balance.

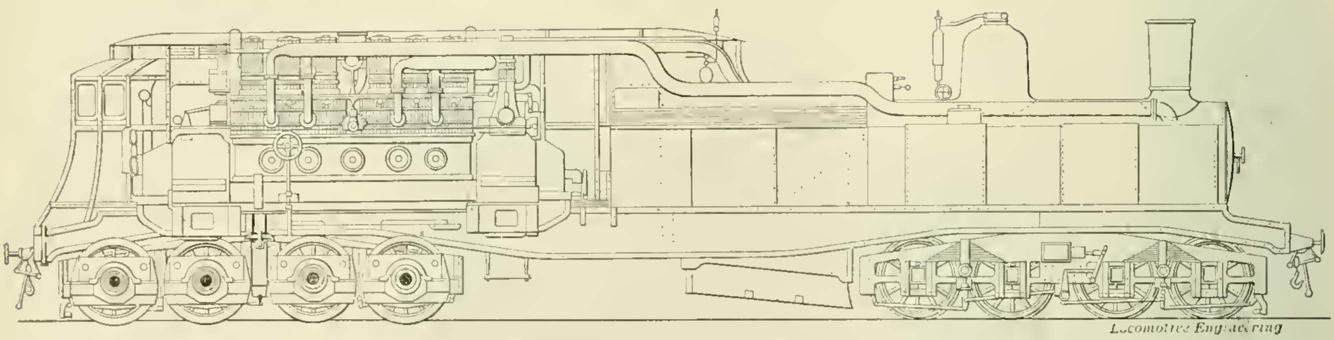
The reciprocating parts connected with the outside crank pin are balanced so far as these crank pins are concerned, and the smaller parts connected with the inside crank pins are unbalanced so far as crank pins are concerned, but these two unbalanced elements are designed to be equal, and being connected with crank pins which are diametrically opposite, their motion is opposite, and hence hold each other in equilibrium—one is balanced by the other.

This engine was mounted upon the locomotive testing plant of Purdue University, which provides supporting wheels carried by shafts running in fixed bearings, receiving locomotive drivers and turning them, brakes mounted upon the shafts of the supporting wheels and having sufficient capacity to absorb continuously the maximum power of the locomotive and traction dynamometer to indicate the pulling force exerted by the locomotive wheels. The arrangement of the plant is such that a locomotive mounted upon it be driven by its own steam at any speed and under any load, the conditions being similar to those of the track.

The tests were made under the supervision of Professor Goss, and represented a variety of speeds up to 299 revolutions per minute, or 60 miles per hour. Wires were run through between the driving wheels and the rail, to indicate the uniformity or otherwise of the pressure. They showed that there was little or no variation in the pressure with which the drivers act upon the supporting wheels, and justify the conclusion that the maximum wheel pressure, when the engine is run at speed, is practically no greater than the static pressure due to the weight of the engine. In other words, the so-called "hammer blow" which attends the action of the ordinary engine when run at high speed does not appear in the action of the balanced locomotive.

Heilmann Electric Locomotive.

We have repeatedly mentioned experiments made several years ago on the Western Railway of France with an electric locomotive which generated the electricity used in driving it. That locomotive was invented by Mr. J. J. Heilmann, a Swiss engineer, residing in Paris. The experiments with the first engine built were considered so satisfactory that two heavier machines have recently been finished. Our accompanying engraving, taken from the "Railway World," of London, shows the general appearance of the Heilmann electric locomotive, with a casing, which constitutes an entire covering, removed.



HEILMANN ELECTRIC LOCOMOTIVE.

As can be seen from the engraving, the foundation of the machine consists of heavy steel girders carried by two eight-wheel trucks. When ready for business, the engine is covered with the casing already mentioned. The front is pointed like a big push snow-plow. Above the rear part of the deck, built on the frames, are placed the boiler and coal bunkers, while the principal steam engine, the two generating dynamos, the exciter with its special engine, and the brake apparatus are carried above the leading truck.

The boiler is of the locomotive Belpaire type, provides 1,996.5 square feet of heating surface, and has 35.95 square feet of grate area. The pressure carried is 200 pounds to the square inch.

The engine is a compound six-crank engine, with the cranks set in a form that gives perfect equilibrium. This engine drives two electric generators, continuous-current machines independently excited. The current supplied by the generators is conveyed to eight motors, which turn the axles. Each motor is said to develop 125 horse-power at 62 miles per hour. It is calculated that this novel form of locomotive will haul a train weighing 250 tons at the speed of 62 miles an hour.

It is difficult to understand the purpose of building an expensive locomotive of this sort, since any well-designed locomotive with a boiler giving nearly 2,000 square feet of heating surface will haul nearly double the load at the speed named.

He Understood.

The Professor of Mechanics at an English college records that he once gave a lecture upon the locomotive, and was particularly struck by the absorption of one juvenile listener. He spoke to this student after the lecture, and asked him, "Well, I suppose you understand all about the locomotive now?"

"Yes," was the reply, "all but one thing."

"And what is that?" said the Professor, kindly.

"I can't make out what makes the locomotive move without horses."—"Tid-Bits."

New Riveting Machinery at Schenectady.

The Schenectady Locomotive Works are erecting a new riveting tower in their boiler shop, and putting in two new hydraulic riveters of 75 and 100 tons capacity each. One of the riveters has a gap of 17 feet, while the other has a gap of 12 feet. The riveters are being built by R. D. Wood & Co., of Philadelphia.

Each of the riveters will be supplied with a 20-ton electric crane, furnished by William Sellers & Co., of Philadelphia, the motions of which, hoisting, racking and traversing are performed by electric motors operated by the man standing on the riveter platform and who operates the riveter.

The July issue of the "Locomotive Magazine" contained a very well colored reproduction of a painting by Mr. F. Moore, the well-known railroad photographer. It is a modern English engine of the Manchester, Sheffield & Lincolnshire Railway, designed by Mr. Harry Pollitt, their locomotive superintendent.

St. Lawrence & Adirondack Passenger Engine.

The Brooks Locomotive Works have recently built for the St. Lawrence & Adirondack Railway three eight-wheel passenger engines, which our half-tone shows to be distinctively modern, from almost any mechanical standpoint, and as up-to-date practice goes, there seem to be few loop-holes for adverse criticism. The electric headlight and extended piston rods come out prominently in the picture, as do the safe tender step and the common-sense hand holds on the cab and tender, and also the hand rail depressed at the front so that a man can reach it.

It will be noted that the tender deck is raised to a point nearly level with the running board, a construction that has met with favor where the engine deck is nearly or quite as high as the running board. The cab is large—a good fault—with a big boiler head to monopolize a good share of the space. One thing especially noticeable is the old reliable four-bar guide, which has apparently been out of favor with locomotive designers for some little time, or at least had given way to very strange creations supposedly possessing some points of superiority over the older type. A return to the four-bar construction with its central line of stresses would seem to indicate that there was something wanting in the underhung style of crosshead.

In the engraving of the boiler of these engines is seen an improved construction at the junction of the tapered course with the firebox end, and also in the bracing, which is liberal and heavy, and well designed to withstand the internal stresses. The inside welt sheet at the junction of the side sheets with the roof sheet and the welt sheet at the side of the tapered course are sextuple riveted, while the circumferential seams are double riveted. These details stand as exponents of an intention to carry a high pressure on large boiler. Below will be found some particulars of interest:

Type of engine—Simple.

Fuel—Bituminous coal.

Weight in working order—Total, 122,300 pounds.

Cylinders, diameter and stroke—18 x 26 inches.

Slide valves—Richardson.

Driving wheels, diameter over tire—64 inches.

Driving wheel centers, kind—Pratt & Letchworth cast steel.

Tires, kind—Latrobe O. H. steel.

Engine truck wheels, size—28 inches.

Engine truck wheels, kind—B. L. W. cast steel centers, steel tired.

Boiler, type—Belpaire, Carnegie steel.

Boiler, outside diameter at smallest ring—60 inches.

Boiler pressure—200 pounds.

Boiler covering—Magnesia sectional.

Firebox, type—Sloping over frames.

Firebox, material—Carnegie steel.

Firebox—Length, 107⅝ inches.

Firebox—Width, 40⅞ inches.

Tubes—Number, 274; diameter, 2 inches.

Heating surface—Tubes, 1,646.7 square feet.

Heating surface—Firebox, 167.46 square feet.

Heating surface—total, 1,814.16 square feet.

Grate surface—30.4 square feet.

Tender wheels—Number, eight.

Tender wheels, make—33-inch National.

Tender frame, style and material—Square channel steel.

Tender—Water capacity, 4,200 gallons.

Tender—Coal capacity, 8 tons.

Metallic packing, kind—United States.

Bearing metal, material—Brass.

Brakes—Westinghouse 9½-inch pump.

Train signal—Westinghouse.

Brake beams—National, hollow.

Safety valves—Three-inch Richardson, muffled.

Lubricator—No. 9 Nathan.

Injectors—No. 8 Monitor, 1888.

Steam gage—Ashcroft.

Whistle—B. L. W.

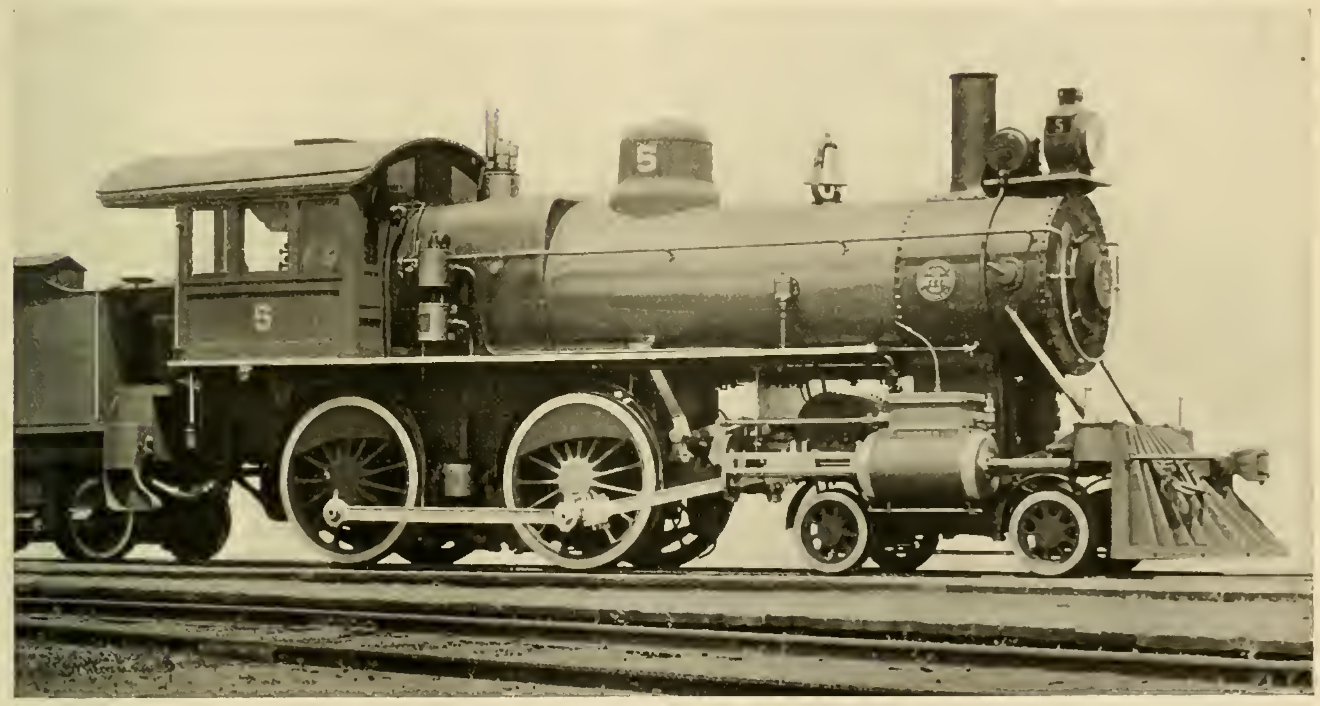
Springs—A. French Co.

Headlight—Pyle electric.

Gould coupler, front and rear.

Pressed steel smoke arch front and door.

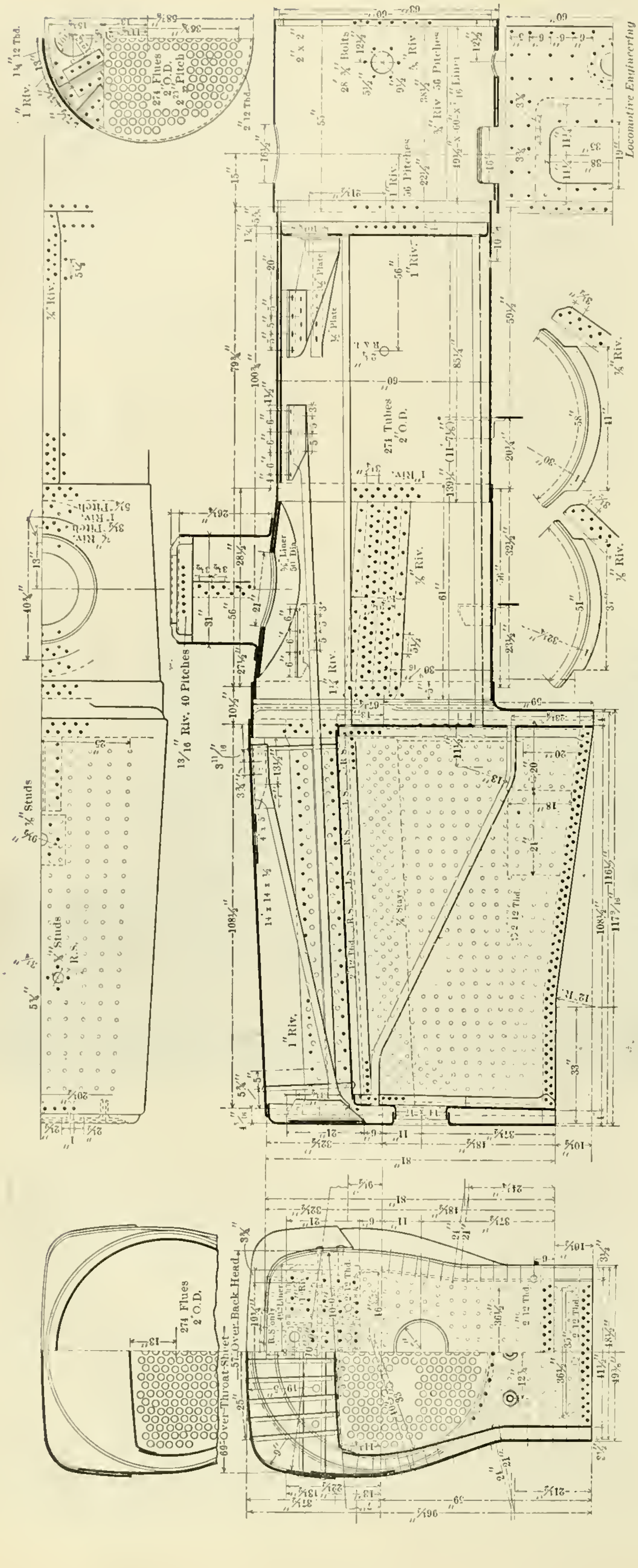
Leach sand blast.



ST. LAWRENCE & ADIRONDACK PASSENGER ENGINE.

At the Schenectady Locomotive Works there is a large amount of wrought scrap worked up in the course of a year, and the billets piled up by the cord attest that hammered scrap is still used to a considerable extent by the patrons of the works. Great care is exercised in the rattling of this scrap—not to get the rust off—but to leave enough on, for the reason that the oxide on scrap iron forms an excellent flux for welding.

The North Eastern Railway of England, which used Joy's valve gear for a time and abandoned it, have returned to its use. They are putting it on all new engines.



ST. LAWRENCE & ADIRONDACK LOCOMOTIVE BOILER.

Throttling of Steam Under Investigation.

A committee of the Traveling Engineers' Association, of which W. E. Widgeon, Logansport, Ind., is chairman, has sent out the following circular:

Your committee on the fourth subject for discussion at our next annual meeting, viz.: "How should a locomotive be operated to secure the most economical use of steam and fuel, speed and weight of train to be considered?" desire answers to the following questions, and any other information on the subject that will be of benefit or interest to the association:

1. In your judgment, should a locomotive be worked with throttle wide open under all possible conditions? 2. Do you consider it economical for enginemen, when possible, to regulate speed with throttle with reverse lever, or with both? 3. Do you consider it good judgment to work steam expansively beyond a certain limit; if not, where would you place the limit? 4. To attain the most economical results, would you carry water in boiler as high as possible? If so, why; if not, why? 5. Have you ever compared the coal record of a wide open throttle engineer with the man who runs with throttle partly closed? If so, what were the results? 6. Do you consider the loss from condensation, caused by working steam too expansively, sufficient to warrant partially closed throttle with longer cut-off?

Some Kinks on the New York, Ontario & Western.

The Middletown shops of the New York, Ontario & Western Railway have had a metaphorical eye on the front as their proper location with reference to air practice, and they have a Richards compressor to furnish the wind wherewith to back their claims to consideration. Among their novel applications of air to special tools, is that of grinding steam pipe joints by means of a Phenix drill with air for a motor; it does a neat and quick job, better than any heretofore done by old-school methods.

Something different from general practice is in vogue here, in the way of a grinding process to remove the raised edge at the end of flues occasioned by the cutting-off disk on the scarfing piece. This is done with old discarded emery wheels that have been worn down to the limit, and which are placed on the spindle of the cutting-off machine, replacing the cutter. A few revolutions of the wheel smooths down the flue end and leaves a clean surface for a joint at either end. There is reason to believe that a flue should make a more lasting joint between sheet and ferrule, with the scale removed, than with it on, and the results obtained by grinding seem to bear out the supposition.

Two of a Kind.

The annexed engravings show a new Holman locomotive recently built by the Baldwin Locomotive Works, and a design of a locomotive patented by W. W. Maddox, Atlanta, Ga. Both inventions are based on the idea of gaining speed by means of gear wheels or their equivalent intervening between the main rod and the driving wheels. We show the engines merely to illustrate curiosities of invention.

The leading dimensions of the Holman locomotive are:

Cylinders—20 x 26 inches.

Driving wheels—63¼ inches diameter.

Total wheel base—23 feet 7 inches.

Driving wheel base—8 feet 6 inches.

Weight in working order: Total, including speeding trucks, about 161,000 pounds; on drivers, including speeding trucks, about 113,000 pounds; total, without speeding trucks, about 126,000 pounds; on drivers, without speeding trucks, about 80,000 pounds.

Diameter of boiler—62 inches.

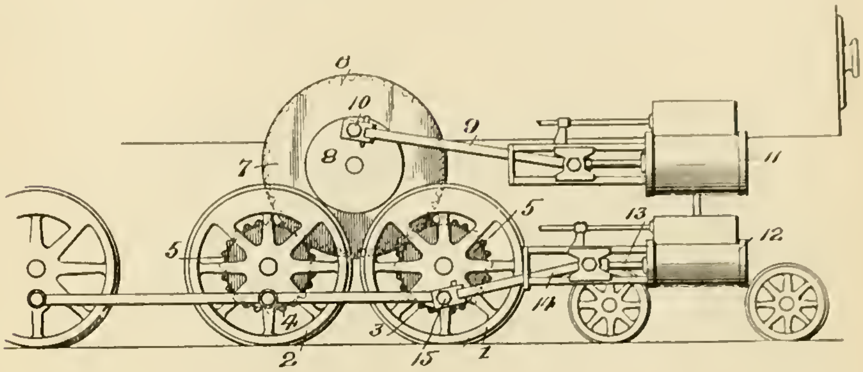
Flues—294 in number, 2 inches diameter; 13 feet long.

Firebox—119 inches long by 42 inches wide.

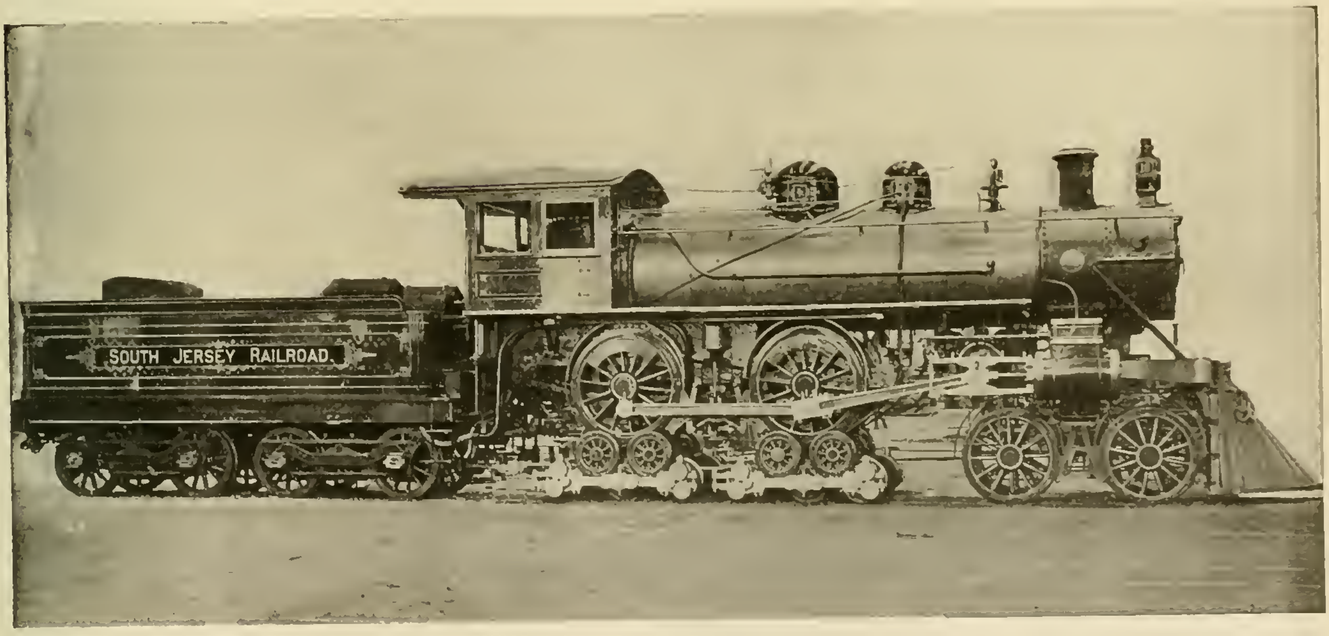
Heating surface—2,156 square feet.

Diameter of engine truck wheels—50 inches.

Tank capacity—4,500 gallons.



MADDOX LOCOMOTIVE.



NEW HOLMAN LOCOMOTIVE.

The engine is equipped with Janney coupler, sectional magnesia lagging, Westinghouse air brake on driving, engine truck and tender wheels, and Westinghouse air signal.

Mr. W. P. F. Carroll, of Portland, Me., has patented a sort of a bay window device for the side of a locomotive's cab. It is made to fold back flat against the side of cab when desired.

Railroading with the Confederacy.

BY CARTER S. ANDERSON.

But for the unexpected and complimentary visit, last month, of your Mr. Sinclair to the Chesapeake & Ohio Store, Richmond, Va., the readers of "Locomotive Engineering" would perhaps never again have had the trouble of reading or skipping anything more from me. Although I could not recognize, personally, the elderly gentleman who, accompanied by a lady, came stepping across the numerous tracks and piles of barbed wire frogs and switches which surround the store, I did recognize that he was no stranger to railroad tracks and business. "I called to see Captain Anderson," he said, as he gained the platform of our store, where I met him, and informed him that he had no further to go.

"Well," said he, after being as comfortably seated as a railroad store can arrange, "when are you going to give my young readers another narrative letter?"

So, of course, I could do nothing less than promise to refresh my memory again in regard to those five years of my life which stand out in bold relief, 1860-1865.

The years '63 and '64 were years of raids. You people found out that you could never whip us rebels so long as we could get bread; so you concluded to starve us out. Here in Eastern Virginia we had, in '63 and '64, the Stoneman, Kilpatrick, Dahlgren, Sheridan and other raids. By looking on any railroad map the young readers will see that a raid into East Virginia from the north must very soon strike the Virginia Central Railroad. It lay broad side to Washington. The young reader must remember that what during the war constituted the Virginia Central Railroad, running from Richmond *via* Gordonsville and Staunton to Clifton Forge, and whose locomotive equipments consisted of twenty-six little wood-burning engines of from ten to eighteen cars capacity, now forms a part of the great Chesapeake & Ohio system of 1,200 miles of main line and 375 locomotives, many of which can tug along with fifty 30-ton cars. It took fifty millions of New York money to adopt the little old Virginia Central and re-christen her "Chesapeake & Ohio." As to whether Mr. Huntington and his New York confreres, who furnished these millions, have ever gotten them back, or would ever like to do so, it is not my province to know or discuss. I can only say for their comfort, that the strongest tie that now unites the West and East is the Chesapeake & Ohio cross-tie and 100-pound steel rails.

It will also be seen by reference to the map, that the Gordonsville bend of the road made this portion the most exposed during the war, from Hanover Court House to Charlottesville; and this happened to be the very portion which was General Lee's main dependence for transportation of his army and supplies. This important fact, of course, attracted still further the attention of the Federal military, and they continually sought, and repeatedly accomplished, the destruction of the bridge, track and depots, which were all more or less filled with General Lee's army supplies. The Virginia Central Railroad, connecting with Orange and Alexandria *via* railroad at Charlottesville, was the main feeder for General Lee's army. So highly did he appreciate the importance of this road, and its necessity to his army, that once when our superintendent resigned on account of some interference on the part of the military, General Lee made the position of our superintendent (Mr. H. D. Whitcomb) a military necessity and commissioned him with the title of Major. He also issued an order, which we boys gladly posted in our cabooses, cars, tenders and telegraph offices, that no officer or soldier under his command should in any manner interfere with the management of this railroad, or dictate as to the *modus operandi*. All during the war our general yard master was Cornelius Tyler. He was nearly as well known as any man in Lee's army. "Neal" Tyler, as he was familiarly called, was fond of the "pomp of office." The officers gladly allowed him the honor even of being general manager, so long as he was willing to assume, also, the responsibility, worry and trouble incidental to the honor. Neal liked it all, except sometimes it got too hot for him. He kept one of General Lee's orders posted on his hat.

Just here I cannot withhold a little incident which illustrates "Neal's" love of official position and sense of humor, as well as the great demand upon our twenty-six little locomotives and meagre equipments during the war. That these little old wood-burners played a most important part in crowning the Confederate army with victory time and again, cannot be questioned. That no historian has ever given to the railroads their just measure of honor, is but an additional proof that from the public whom they zealously serve, they must always thus expect large blame and no praise.

It was in '62, just after the seven days' fight around Richmond, when we were busy transferring General Lee's army from the vicinity of Richmond to Gordonsville to meet Pope's army. Train Master Tyler has just loaded out every available engine and car, and feeling greatly relieved of this burden, he had taken a sociable drink at the Antilotti bar-room in the passenger room at the depot. He stepped out upon the pavement to view the cleared-up yard, and saw, coming down Broad street, a cavalry officer, who rode almost up on Tyler and demanded to know where he could find the superintendent.

"I am he, sir," said Tyler.

"Well," said the officer, authoritatively, "I want ready here in twenty minutes three trains of twenty cars, to load up with those soldiers now coming down the street."

Tyler coolly, and in a dignified tone, replied: "Well, General, I have already sent out every single engine and car that can turn a wheel. But alight and be seated. I'll go up at once and order Master Mechanic Freeman to build three engines, and have Master Car Builder Childs put up sixty cars, and have 'em here in twenty minutes!"

The officer dismounted, and after most civil inquiries learned that his men must go foot-cavalry in the direction of Gordonsville until they would meet the empty trains returning, and be taken up by them.

These cavalry raids were always greatly exaggerated. The terror and consternation that preceded them in many cases did more harm than the actual presence of the soldiers. The points oftenest raided were Atlee, Hanover Court House and South Anna Bridge, the latter five times burnt and five times rebuilt, and standing when Richmond fell.

Beaver Dam Depot was raided once in '62, once in '63 and twice in '64; Fredericksball and Louisa Court House each twice. It is a remarkable fact that Gordonsville was never captured from us during the war. In '62 General Pope got in sight of it, but we ran Jackson's division into the town just in time to see the blue uniforms coming down the little mountain, and they soon disappeared, making a stand and giving old Stonewall a desperate fight at Cedar Mountain.

I intended to tell in this letter of the Kilpatrick-Dahlgren raid, which came in from Fredericksburg and crossed near Beaver Dam; but I must reserve that for some definite dates, and will then try to set it before my readers, as I know it from personal experience, and from the experience of eye-witnesses and participants personally known to me.

The raid upon and the burning of Hanover Court House Depot by about 100 men from Stoneman's command was May 4, 1863—about the time of the fight at Chancellorsville. The raiders came from the direction of Fredericksburg, bearing down on the King William side of the Pamunkey until opposite Hanover Court House, then crossing over and heading directly to Hanover Depot. They reached there about night, and completely destroyed the depot and several cars, all full of army supplies.

Mr. James D. Christian was the railroad agent there then, and lived in a company building about fifty yards from the depot. Mr. Christian had a happy family, consisting of a wife and five beautiful, curly-haired daughters and one little son. They were all seated at supper in the basement of their dwelling, in sight of the depot. Mr. Christian had two servants, Aunt Maria and her daughter. They were the house servants, and what our colored people call "white folks' niggers." Presently and suddenly the door opened, and Aunt Maria came in. She stepped out into the middle of the floor and assumed that absent-minded, stiff, staring appearance—the indescribable and inimitable condition into which the genuine African gets when converted, and relating his experience. All eyes turned toward Aunt Maria, and the girls began to giggle. "Hep yoursef, Mars Jim. Hep yoursef, Miss Ellen. Hep yoursef, young missises. De Lord done come, and I am free!"

"Oh, do pray, Maria, go along and let us finish supper," said Mr. Christian. Just then Aunt Martha, who was waiting on the table, happened to look out of the window toward the depot, cried: "Law, Mars Jim, what white folks is dese?"

Mr. Christian jumped up, and, seeing the whole depot yard full of cavalry (Federal), took in the situation at once. Turning to Aunt Maria, he said: "The Lord is come you say? The devil is come, more like!" He then turned to his wife and told her that the yard was full of Yankees, and that they were setting fire to the depot. "This house will certainly be burnt, as it is so near, and all the railroad property, too," said Mr. Christian. "Take the children and servants, and carry everything out of the house that you can and pile it up in the garden yonder. I will go out and beg the commander to spare the house."

In less than twenty minutes the old frame depot and several cars full of stores were ablaze. Mr. Christian humbly approached the officer in command and begged him not to destroy the building.

"I am sent here, sir," he said, firmly, "to destroy this property as a military necessity. My orders are, to burn *all* railroad buildings." The officer, in turning from the burning depot to speak to Mr. Christian, caught sight of Mr. Christian's garden. The furniture had all been dumped in the back part of the garden, in a pile. Mrs. Christian and a half-dozen girls (her daughters and cousins), all the servants and all the dogs, were grouped together. The dogs all thought it a frolic, and so did the girls, who had gotten into a perfect glee. There the girls stood with their hair blowing to the breeze, and all curly haired; there by them the nappy-headed negroes and the curly-haired dogs. The great blaze brought out this scene in bold display to the commander, and, turning to Mr. Christian, he said: "Is *all* this your family?" "Yes," said Mr. Christian, "and I am their sole support. If you take away our house, we are out of doors."

"Well," said the officer, "the house shall not burn. I will order my men to protect it." He then took a good look at the scene and said: "If I could truthfully reproduce this picture and carry it North, there would be no more war." The officer then ordered his men to spare the house, and gave Mr. Christian some substantial proof of his humanity.

Little Willie Christian had followed at his father's heels, and hearing the good news, rushed home to tell his mother that the house was spared. This produced a happy change of scene. Each person began to recover for herself her dear possession, and in the general chaos to find her especial treasure. "Whar's my child?" cried Aunt Martha, suddenly remembering that she hadn't seen him since the excitement began. "Where's my new hatbox?" cried Mrs. Smith (Mr. Christian's married daughter). She had just gotten this new bonnet from Richmond, and it stood first in her affections. "Here's yo' band-box, Sue," cried one of the girls. "And, horrors! Aunt Martha, here's yo' baby in the box, on top of Sue's new bonnet!" Nothing could have been more ridiculous, and the fun of the girls waxed fast and furious, until Mr. Christian, not knowing the cause of the fun, came up and said: "Come, come children, how *can* you do so, under such distressing circumstances?" But the glance he gave into the box where the black lump of humanity lay reposing, for once in its life, upon a bed of roses, was too much for old sober sides, and he, too, joined in the fun.

In half an hour every soldier had gone, and nothing but the huge pile of smoking embers, casting their weird light against the sky, was left to speak of their visit. Such is one experience from a cavalry raid.

Richmond, Va.

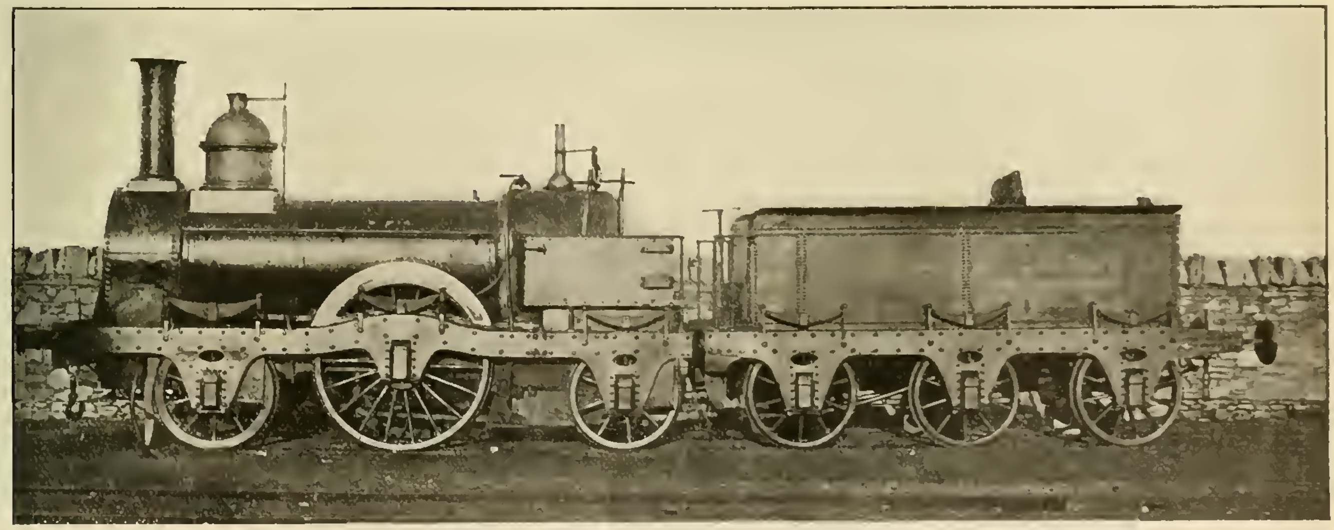
Joys and Woes of a Railroad President.

The Hon. Chauncey M. Depew addressed the New York Railroad Club several months ago. In the course of his remarks he said:

"Now I trust that all of you gentlemen some day or other will be railroad presidents. The railroad president can join with the policeman in the 'Pirates of Penzance,' where he says that the policeman's lot is not a happy one. The railroad president is expected to show increasing dividends to the stockholders, to give constantly increasing wages to his employés and service to the public for nothing. If he fails to satisfy them, he is abused in the press and laws are aimed at him in the legislature; and if he fails to satisfy his employés he wishes that he had never been born. Now, on the prongs of that trident he goes through his career, seeking to maintain an equable disposition, to retain the constitutional amiability of his character, and to be able to express himself on all occasions in such language as is recognized in polite society and will not offend the most modest in the home circle, and at the same time get his share of fun out of life.

A PIONEER FIRST CLASS ENGLISH CAR.

"As a railroad president for the last—now going on twelve years—in contact with railroad presidents for thirty years, I have discovered that there is only one thing to do—try to make your railroad, as best you can, the best railroad there is going. Treat the public with absolute fairness and frankness and tell them all about it. Have no secrets. Present to the stockholders a perfect balance-sheet, showing just what you have done, and if they do not like it have your resignation all ready on a plate. Have your door wide open for any man in the service of the company, no matter how humble, and let him take precedence of all other business. When I adopted that rule, my brother railroad presidents who had been longer in the service all over the country said, 'You are going to ruin the service, and overwhelm us with complaints of every kind; we will be unable to transact


PIONEER IRISH EXPRESS LOCOMOTIVE.

any business.' When I first announced the rule, dozens came from all branches of the service; but when they found that some complaint they brought was considered in all its bearings, and it was incumbent upon them to show a cause that would satisfy fair-minded men for making such complaint, they would sit down at the roundhouse, or the shop, or on the track, or in the yard and say, 'What is the matter, and how would that look before an intelligent railroad president understanding that business as well as we do ourselves,' and in ninety-nine cases out of a hundred they did not come, and the friction which ordinarily occurs disappeared entirely."

A Bicycle Railroad.

The Boston, Quincy & Fall River Railroad has recently been incorporated to build a road from Boston to Fall River. This is to be on the one rail or "bicycle" plan, and it is not surprising to see the name of E. Moody Boynton among the officials. Mr. A. H. Overman, of Victor bicycle fame, is also one of the promotors of the scheme.

Another Pass Story.

The little note about the employé obtaining his pass by argument, on page 646 of the August issue, has brought out another story in a similar vein, said to be an actual fact.

Two roads paralleled each other to an out-of-the-way place, and the alleged train manager arranged his schedule so that some of the crews had to lay over Sunday in Nowhere. They immediately asked for passes back to civilization, so they could come down on the last train Saturday and spend Sunday with their families—or at a ball game.

Then the superintendent—also one of the misfit brand—issued orders that no passes should be given, and no one carried without a pass; vowed he would keep them up there where they belonged, and not carry them over the road twice for nothing. Imagine his surprise, on the next Saturday night, to see the whole crew back in town, in spite of orders and no passes.

When they got in Monday, they were called up for examination and explanations, for the superintendent was mad clear through.

"How did you come down here Saturday?"

"Rode down."

"But I gave orders that no one should be carried without a pass."

"Had a pass."

"Who in thunder gave it to you?"

"Mr. T——, the superintendent of the other road."

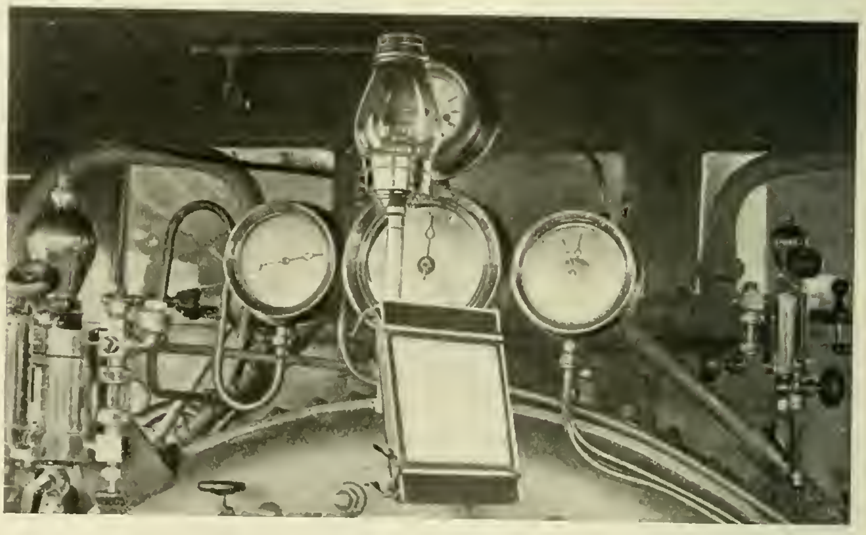
"But that wasn't good on our road."

"Didn't come on your road; came on a better one; had decent cars, decent road-bed and a better engine. There the superintendent knows his business, too; is a railroad man, instead of a reformed farmer; said he'd give us a pass every week if this one-horse road was too blamed poor to do it."

Needless to say, the superintendent was mad. He raved about being under obligations to other roads, etc.; but finally cooled down, saw that the only way he could help it was to give the passes himself, and the men came home Saturday nights after that until the run was changed.

Train Order Holder.

The annexed engraving shows the cab of engine No. 15, belonging to the Florida East Coast Railway, built with the B. L. E. train order holder secured in a prominent position, where it is not likely to be overlooked by the engineer. This is the holder designed by S. L. Harman, of St. Augustine, Fla., and which has been repeatedly mentioned in the pages of "Locomotive Engineering." It has been adopted by the Florida East Coast Railway and will be applied to all the engines.



B. L. E. TRAIN ORDER HOLDER AS SEEN IN CAB.

The Treacherous Steel Still Progressing.

About twenty years ago certain engineers, mostly in the United States, began specifying steel for the construction of boilers. A great outcry was at first made against the treacherous steel for such a purpose; for it was rightly argued, the best material is not any too good for such an article as a steam engine boiler, where so many lives may depend upon its immunity from accident.

In spite of much opposition begotten of ignorance, and the engineering conservatism that so often clings to old methods and tried material, the progressive men insisted that the ordinary run of good steel was more reliable than iron, and within a few years a complete revolution was effected, and those who had shouted most loudly for iron soon forgot that they had said a word against steel.

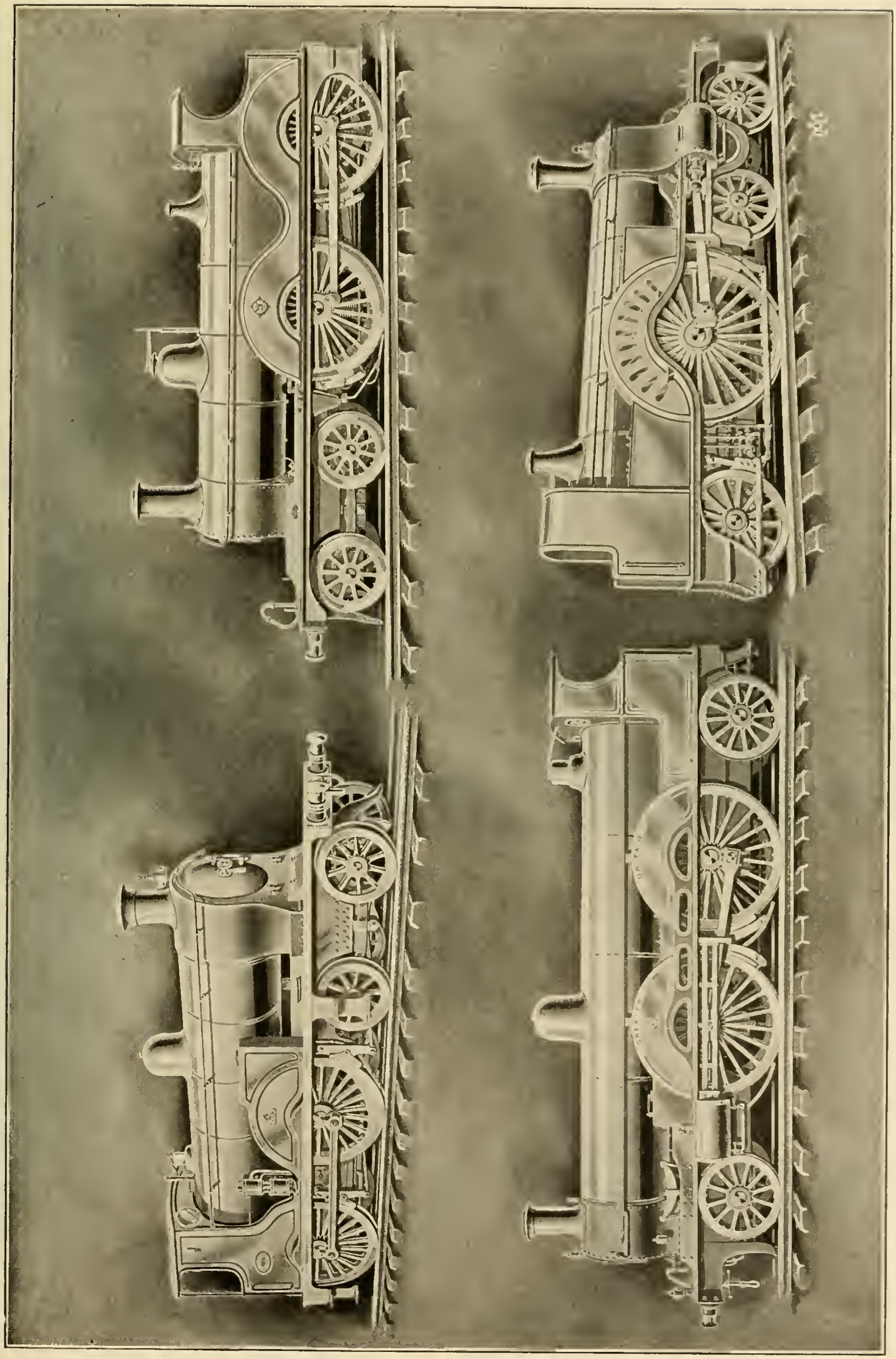
A similar operation of evolution is going on in other lines of engineering where steel is still looked upon as a treacherous material. More light and more intelligent experience are likely to lead to the same results in the general introduction of steel to all kinds of machinery as they did in making it the universal material for boilers.

Fast Run on Lake Shore.

We learn from Mr. George W. Stevens, superintendent of motive power of the Lake Shore & Michigan Southern, that on July 30th two of their well-known class of ten-wheel passenger engines, built at the Schenectady Locomotive Works, ran train No. 36 from Cleveland to Buffalo, a distance of 183 miles, leaving the first named place one hour and sixteen minutes late and arriving at Buffalo twenty-eight minutes late, which includes going around the "Y" at Buffalo, coming to a halt for New York Central switch engine to couple on and back to New York Central Depot and coming to a halt there. The stops made were as follows: Painesville, Ashtabula, Erie, Brocton Junction, Dunkirk and Erie Crossing at Buffalo. The train consisted of two express cars, one postal, one baggage, one smoker, two coaches, two sleeping and one dining car—total, ten cars.

During the trip in two instances a speed of 75 miles per hour was reached, in one instance 78 miles per hour, one instance 87 miles per hour, one instance 77 miles per hour and one instance 66 miles per hour.

Those who want a copy of the Air Brake Men's proceedings should apply early. They are going off rapidly.



GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 9.

MODERN BRITISH PASSENGER ENGINES.

Cleaning Out Ashpits.

The ashpit is usually an eyesore around any round-house, and the continual dumping and cleaning, or partial cleaning, takes more time than many imagine, besides never being really clean. The arrangement at the Meadow shops of the Pennsylvania Railroad, patterned after the one at Altoona, is a very neat and efficient device, which seems worthy of being more generally adopted.

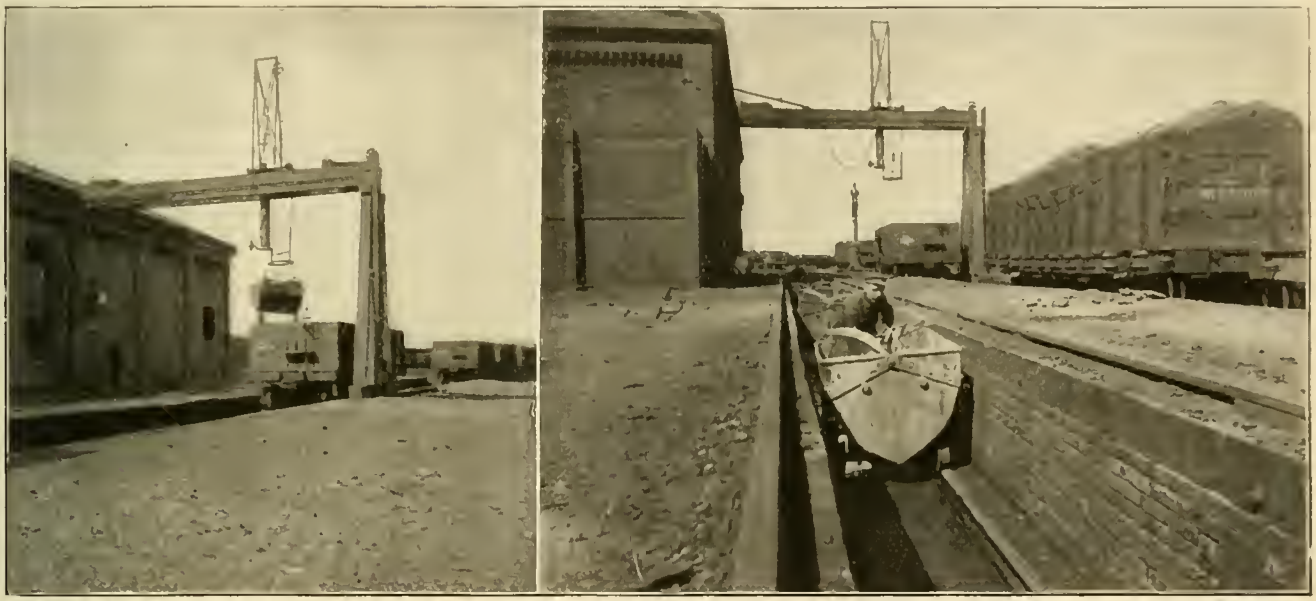
The illustrations give a fair idea of the general arrangement, which is beside the sand-house, just outside the round-house at this place.

The bridge spans the dumping track and another beside it, which holds the cars for carrying the ashes away. The right-hand view shows the cars, or buckets, which rest on four-wheel trucks in the pit.

be raised double this distance by means of the sheave wheel and rope shown, which doubles the travel of the rope.

The traverse cylinder is of wrought-iron pipe, with an internal diameter of 7¾ inches and a travel of 3 feet 10 inches. This travel is multiplied four times by the same method of rope and sheaves, so that the full length of bridge can be covered. The buckets weigh 525 pounds, and have a capacity of 1,100 pounds. The hoisting cylinder carries a signal lamp, and a headlight is placed against the building as shown, to prevent any collisions at night. Both air cylinders are worked by engineers' brake valves at the side of the building, a man being shown operating them in the left-hand view.

Power is supplied by a 9½-inch Westinghouse air pump at a pressure of 120 pounds per square inch.



ASH-HANDLING PLANT.

When the engine comes in it stops under the crane, with its tank by the water spout and its sand-box under the pipe, which is seen projecting from the sand-house this side of the bridge. At the same time the men run a car under the ashpan and one under the front end, and both the ashes and cinders are dumped into them while the sand-box and tank are both receiving their respective contents. In this way all the operations are performed, and the engine is ready to leave the pit in twenty minutes—quite an item when several are waiting for their turn. When an opportunity presents, the cars are run under the crane, the air hoist run over the pit and the ash dumps lifted out of their trucks, run over the other track and dumped into the car by hoisting until the levers come in contact with the ring shown. This dumps the load by opening the bucket.

The hoisting cylinder is made of cast iron pipe, 12 inches internal diameter, and a travel of 6 feet 6 inches. The bucket can

We are indebted to Mr. J. W. Sanford, the master mechanic here, for the figures given. We believe the device was patented on July 20th by Messrs. Wallis & Stratton, of Altoona.

An Australian Calculation.

The mathematical fiend of the "New South Wales Railway Budget" has been wrestling with a book of statistics with the following result, which has the one good point of showing that the passengers of railways are pretty well cared for in spite of all the grumbling we hear on the subject. Here is what he says:

"If a man takes a ride of the average length, which is about twenty-four miles, in a railway train, what is his chance of getting killed?

"According to an official report, carefully prepared, the writer has calculated that it is one chance in 1,491,910.

"Put it this way. Supposing a young man of twenty, jilted by his sweetheart, wished to end his life by getting accidentally killed in a railway accident. Could he do it? Certainly.

"If he were to get on a train and ride, ride, ride at the rate of 35½ miles an hour, day and night, without ever stopping, with average luck he would eventually get surcease from the gnawing pain at his heart somewhere in the course of passing over 35,542,282 miles. Unfortunately, however, he would be injured about nine times before he reached his end. His possible journey would have taken him round this weary world 1,421 times. And the cost? Nearly £150,000! And he would be in his 135th year by the time his desperate purpose was achieved, and it is to be hoped would have more sense than he started with."

P. Leeds, superintendent of machinery L. & N. R. R., is another believer in large main reservoir capacity. All of his freight engines are equipped with two main reservoirs, having a combined capacity of about 28,000 cubic inches. The pump discharges into one, and the train supply is taken out of the other, thereby securing good dry pressure and lots of it. It is needless to add that when they get a fully air-braked train they never run out of air.

The Davis & Egan Machine Tool Company, of Cincinnati, O., have purchased the extensive works, formerly occupied by the W. S. Merrill Chemical Works, of Cincinnati, O.

A patent valve for steam heating apparatus has been assigned to the Safety Car Heating and Lighting Company by Robert M. Dixon, their chief engineer.

Great Northern Locomotive.

The annexed engraving shows a new type of locomotive recently designed by Mr. H. A. Ivatt, locomotive superintendent of the Great Northern Railway of England. Mr. Ivatt has not been long locomotive superintendent, and this is the first important designing work which he has done.

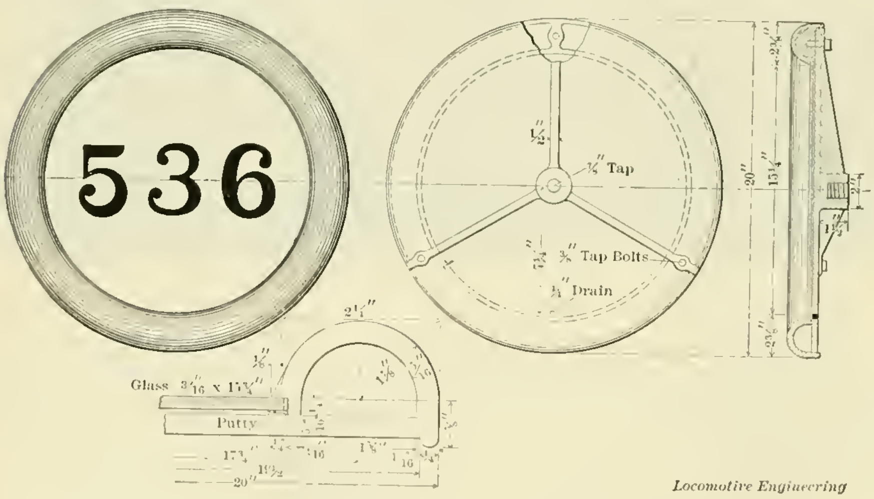
GREAT NORTHERN PASSENGER ENGINE.

It will be noticed that with the exception of having inside cylinders, the engine has what be called an American look, the cab being much larger than we find on the ordinary run of English engines. The cylinders are 17½ x 26 inches stroke and the driving wheels are 79 inches in diameter. The total heating surface is 1,124 square feet. The grate area is 18 square feet and the working pressure is 170 pounds per square inch.

Glass Number Plate.

A most finished and pleasing job for a front-end engine number plate is that shown in our illustration of a design by Superintendent of Motive Power Leeds, of the Louisville & Nashville Railroad, and standard on that line. The whole beauty of the contrivance lies in the use of a glass disk on which the engine number is painted, on the rear or protected side, after which the same side is painted a solid black. The glass is then placed in a plain ring of polished brass having a flange which is faced off true to receive the glass disk; the latter is held in place in the ring by a cast-iron back fastened to the ring by three tap bolts; the back having the usual boss at the center, which fits the stud on the front-end door.

Painting the back of glass black after the engine number is put on, causes the latter to stand prominently forth from its mirror-like setting, and makes it one of the tastiest conceptions for a detail that has corners usually smudgy with lampblack. These are always bright, even when dirty; easy to clean, and cheap to make or repair.



GLASS NUMBER PLATE.

Wasn't Used to Good Braking.

An old lady from Vermont, who had never ridden on a train before, was going to Boston for the first time.

Suddenly the train ran off a switch that had been left open, and the cars were thrown into a ditch. The car that the old lady was in landed right-side up, but she was thrown half the length of the car.

Then she gathered herself calmly up, picked up her bundles and bandboxes, and took a seat, while the other passengers were getting out.

One of these passengers, seeing the old lady sitting calmly among her bundles, said to her, "Madam, why do you sit there? Aren't you frightened?"

"Frightened?" she repeated. "Laud sakes! Why, I thought this was the way they always stopped."

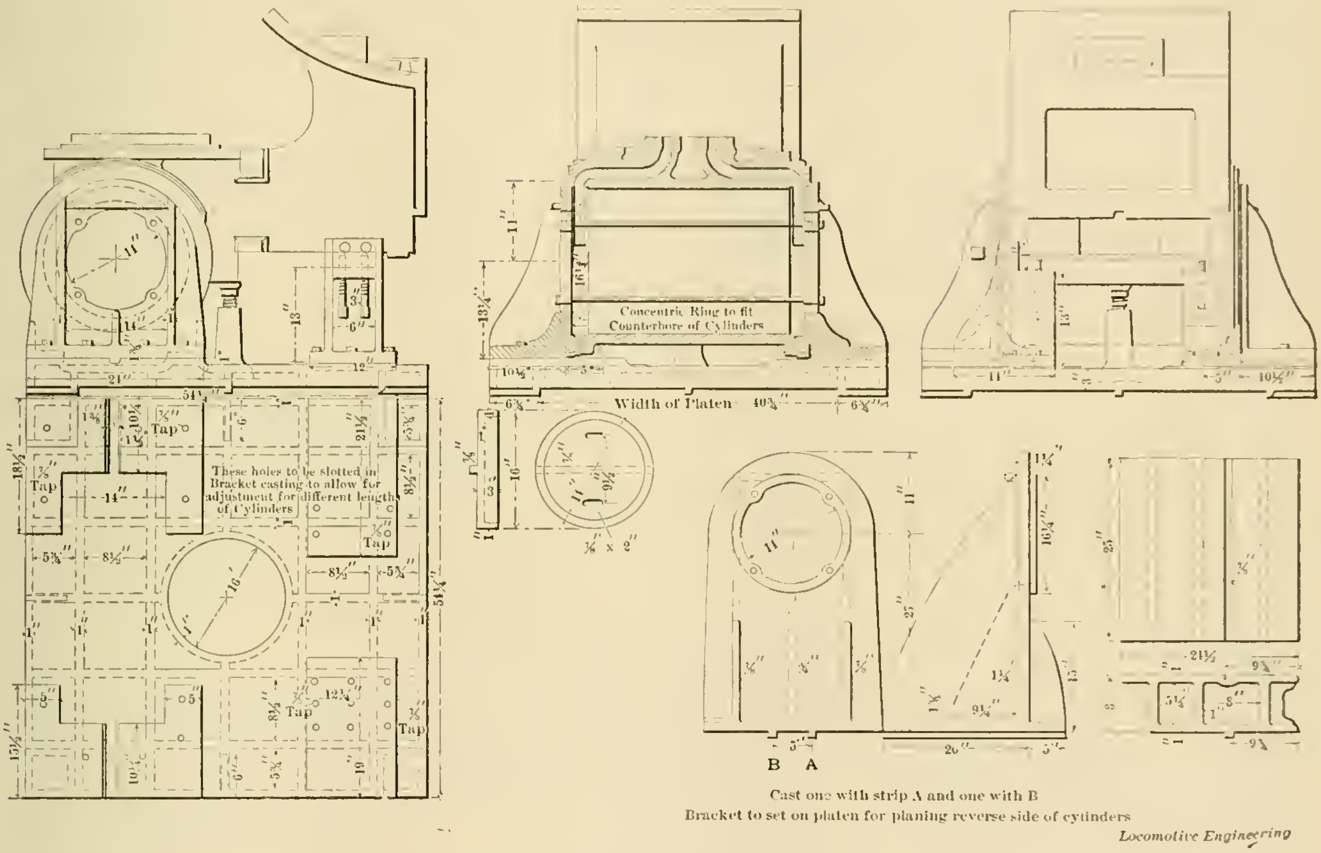
There is a measure before the British Parliament at present which proposes to give compensation to employés in cases of injury received while at work. The purpose of the bill is to take away part of the injustice inflicted by employers in their not being held liable for accidents caused by the carelessness of fellow servants. In tne great corporations which employ most labor nowadays, this fellow-servant business has frequently the effect of preventing the workman from collecting damages for injury received through the carelessness of his employers. One reprehensible feature of the proposed measure is that it permits the "contracting out" of liability by the employer, i. e., it permits employer and employed to make an agreement which prevents the employer from being liable for any injuries received by the employed. Railroad men are particularly opposed to this part of the bill, as it would rob them of any benefits conferred by the law.

An impression prevails among many people in this country that American railroads are the only railroads imposed on by politicians and others for free passes, but a recent agitation in France concerning passes brought out the fact that about seven million passes are issued annually by French railway companies. It is proposed to put a tax on those free passes in France, and a howl of rage has gone forth from those who enjoy the privilege of riding for nothing. The proposed tax is very light, and it might be supposed that those enjoying the privilege of riding free would pay it without any protest, but the political class seem to be the same everywhere, and a few cents imposed upon a free pass is considered a real grievance.

Consul Child writes from Hankow that Walter Kennedy, a citizen of Pittsburg, Pa., has, under the instructions of Sheng Taotai, taken charge of the iron works at Hanyang. He has been making good steel rails, 30 feet in length, at the rate of 120 per day. He seems to understand his business, and the Chinese officials are well pleased at the skill he has evinced in getting their large plant in order. The rails are shipped to Shanghai, to be used on the Woosung Railroad.

Chuck for Planing Cylinders.

The man who has run the big planer in a railroad shop is thoroughly conversant with some of the trials attending the planing of locomotive cylinders, where for want of proper facilities it is necessary to set them up on the planer on the cob-house principle, with wooden blocks and wedges as the means of adjustment. One setting of a cylinder under these circumstances is quite enough to take the enthusiasm out of any man, and this three or more times repeated in order to reach all parts with the tool is wearily gone over before the job is completed. It is well known that the expenditure of time in putting the cylinder into shape to use the tools by this method is almost equal to that devoted to the planing of it.



CHUCK FOR PLANING CYLINDERS.

A chuck that holds the cylinder in line with the bore, and maintains that position rigidly, is shown in the accompanying engraving. It is mounted on a base plate which in turn is bolted to the planer platen. The base plate is made as wide as is possible and passes between the housings of a 54-inch planer, having flanges 1 inch deep, which drop over and fit on the sides of the platen. The centering of the cylinder on the plate is accomplished by the brackets, which are bolted to the plate and have a flange on the inside face 17 inches in diameter, which fits into a ring made to go in the counterbores of the various sized cylinders. Making the flange of one size and varying the rings to suit the cylinders gives a practically endless scope to the usefulness of the brackets.

After bringing the brackets up to the cylinder joints they are bound together with four rods running from end to end. The cylinders are thus set true with the bore, after being squared up with the valve seat and joint at the center, by the set screws seen in the blocks under the saddle, an operation performed with certainty and dispatch, for the cylinder will revolve easily on the rings in the counterbore before strain is put on the rods. The same blocks have set screws to take up the end thrust, and thus the saddle is levelled and clamped at the same time.

The cylinder once set as shown is a permanent fixture until all planing is done on the top and side, so far as disarrangement in the chuck is concerned. The one shift necessary to finish the valve seat and steam-chest seat, in which the cylinder is turned at right angles to the position shown in the engraving, is done by raising the base plate and chuck bodily on the planer platen sufficient to clear the lugs on the plate. This is done by a jack at the center of the base plate, the jack resting on a flanged disk, which in turn is on the planer platen. This disk is turned on the edge to fit the hole freely in the center of the plate, so that when the jack raises the cylinder and chuck to shift their position, they can turn freely around the jack as a center, and are then dropped on the platen and secured to the latter, when the planing may proceed without any further adjustment.

Brackets of a hight to allow the cylinder to be turned completely over are used as in the first instance, when the frame fit is planed; they being in all particulars similar to those shown with the cylinder except the hight. For extremely high saddles this hight is increased by filling blocks, as shown in detail.

This mechanical way of simplifying and cheapening the planing of cylinders was devised by Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville Railroad, where the chuck has been in use for a long time, giving the most flattering returns for its cost.

At some of the railway stations in France where passengers' baggage has to be examined, to prevent smuggling, the use of X-rays has been introduced as a means of detecting prohibited articles. As such articles are nearly always held in bottles, the new method of examination is proving highly satisfactory. The travelers who are not given to smuggling prefer the new method to the old one, which entailed the pulling out of the contents of any package.

The Pennsylvania Railroad recently made a fast run from Chicago to Pittsburg. No special preparations were made, the engines regularly in service being used to haul the three special cars, which were occupied by Vice-President McCrea, General Manager Wood and a party of officials. The distance is 546 miles, and it was run in 9 hours and 25 minutes (565 minutes).

Practical Letters from Practical Men.

Smith's Duplex Boring Bar.

Editors:

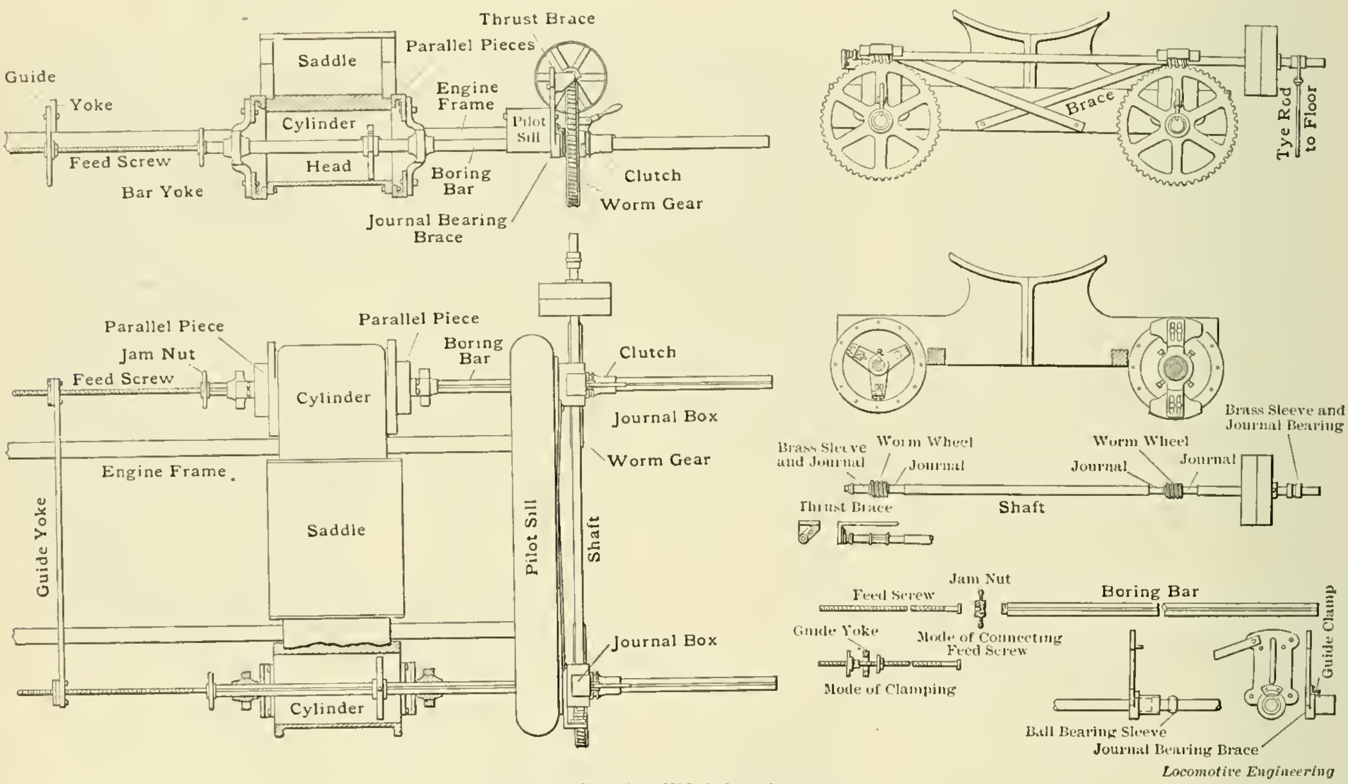
I send you to-day a blueprint of my recently designed giant double boring bar, by which we bore out both cylinders of a locomotive at one time. By referring to print you will see that the driving power is bolted to the pilot sill. The worm wheels are 30 inches diameter, and worms 4 inches diameter. The proportions, you can readily see, will give all the power that a tool can be made to stand. The feed screws are, respectively, 7 and 9 threads to the inch, and any size desired cut can be taken.

We have tested the capacity of this tool on two engines, of which we bored out the cylinders and bushed them. The cylinders were bored to 19 inches, and total length of cylinders is 32 inches. Both cutter heads traveled through in 1 hour and 37 minutes.

The usual ways of boring out cylinders in the average railroad shops are very slow, sometimes taking several days. This bar reduces the time for such work from days to hours. The tool is easy to adjust, takes any spread of cylinders, and there is no need of taking off pilot sill, deck nor arch braces, as is usually necessary when using other boring bars. It is very steady and rigid, and does not chatter. Power is limited to the strength of the cutting tools, and can be operated by either air, electric motors or power. It can be built very cheap, and I am confident it will do four times as much work as any single bar now on the market.

D. O. SMITH, M.M.,
Mobile & Ohio Railroad.

Whistler, Ala.



SMITH'S DUPLEX BORING BAR.

Work of Moving a Locomotive.

Editors:

It appears to me that your article entitled "Labor of Pushing a Locomotive Through the Air" draws mistaken conclusions from coal consumption.

At once there comes to my mind that the heaviest straight trip, in point of coal consumption, I ever made over a certain engine district was also the slowest—and slowest, not on account of heavy train, but demoralization of wires by wind and ice, so that we spent a large part of our time on side tracks.

This suggests to me that there is a large amount of coal burnt in a locomotive which is constant, whether the engine is pulling a load, running light, or only standing still, keeping warm. The kind of weather and strength of wind, as affecting radiation, stack-draft, etc., have an important influence.

It is, I suppose, to be taken for granted that, in the test of the light engine you refer to, care was taken that, owing to free steaming or light coal, the amount of popping was not in excess of that of engine with train, and that the fire door was not kept partly open, to dilute and cool, and, therefore, waste products of combustion.

But, at best, there's a large unknown constant, which, both in the loaded and light engine's record, should first be deducted, before the fuel actually chargeable to wind and other resistance is found.

The wind resistance at 16½ miles per hour is not great when figured in horsepower, even against the large surface projected into the wind by a locomotive. Unfortunately for the pneumatic-tired, Pony-trucked, single-drivered tyro on a bicycle, he is not a horse, nor possesses more than a wee fraction of the rather too powerful mechanical "horse-power," and he is likely, even proportionately, to suffer more from "no steam" than his forty-ton competitor, to which, in the matter of wind resistance, you liken him.

At 16½ miles per hour, the pressure on each square foot of the engine's projected area is about 1.4 pounds.

Taking projected area of a locomotive on a plane at right angles to line of motion, wind resistance at stated speed amounts to about 7.3 H. P., which will not take much coal at any conceivable rate of combustion.

E. H. MUMFORD.

Elizabeth, N. J.

[The facts and figures given by Mr. Mumford appear to be all right, yet nevertheless we adhere to the figures given in our article. They were the results of an actual experiment. The superintendent of motive power of the Pennsylvania lines west of Pittsburg, while investigating the question of what weight of trains certain locomotives should pull, had a consolidation engine run light over a division at a speed of 16½ miles an hour. The coal consumed was weighed and amounted to 30 pounds per mile. The quantity used does not agree with rules on the subject, but it is one of those stubborn facts that cannot be argued out of sight.—Ed.]

Tool for Reverse Shaft Journals.

Editors:

The sketches herewith represent a tool for turning the ends of a reverse shaft, which need not swing in the lathe, and can therefore be operated on in any small lathe of sufficient capacity to receive the job on its centers.

The tool consists of piece *A*, Fig. 1; the center *B*, the cutter-bar *C*, which has a left-hand thread ⅛-inch pitch; the two gears *D* and *D'*, with 46 teeth ¼-inch circular pitch, and the star *E*. Gear *D* is threaded to receive the left-hand thread on the cutter *C*, and when revolving will move the cutter-bar ahead.

It is used in the following way: Referring to Fig. 2, the lathe spindle is seen to receive the taper shank of the center *B*; the reverse shaft is then put on the centers and held with a steady rest to prevent springing out of line, after being placed so that the arms on the shaft will not be in the way of the operator. The switch plate *F* is bolted on the left end of the lathe carriage by two bolts, so that the latch *G* will turn the star wheel *E*, and thus feed the cutter-bar 1-6 of ⅛ = 1-48 inch at each movement of the star.

When the cutter *H* reaches the shoulder of the shaft, the latch is switched off by moving the handle *K* to the left, by which movement the feed is stopped and the tool makes a fillet. This tool was made, and has been in use, at the Northern Central Railway shops, at Elmira, N. Y. It does its work very satisfactorily, and is a handy device to have when large lathes are busy with other work.

J. A. Eisenaker.

Elmira, N. Y.

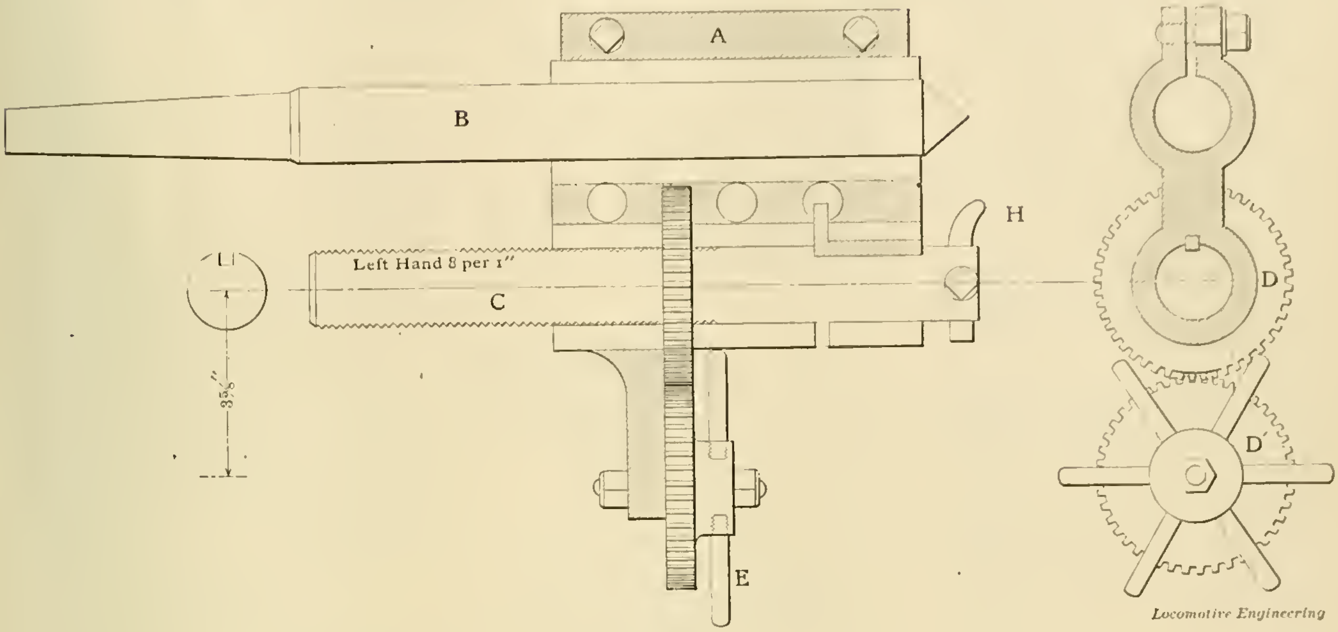


Fig. 1

TOOL FOR REVERSE SHAFT JOURNALS.

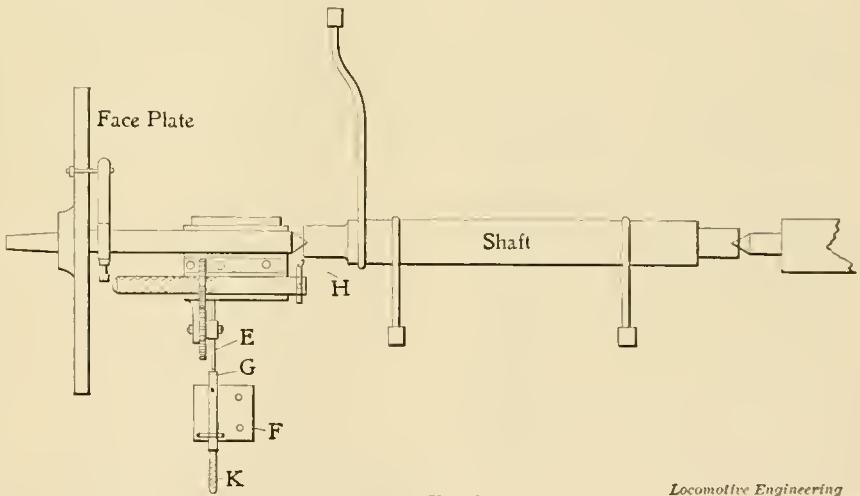


Fig. 2

TOOL FOR REVERSE SHAFT JOURNALS.

To Cure Priming Caused by Bad Water.

Editors:

I see by your April number, one of your subscribers in Howrah, India, inquires if foaming, or what we call priming can be prevented when it is caused through the use of water having a saline or alkaline matter in it. We are three parts of the year using very bad water on the road I am working on, and I am, therefore, speaking from experience about the remedy we apply.

There are only two things to prevent foaming, under the circumstances described—one is the use of castor oil, the other is the use of glycerine. To prepare the remedy, you fill the oil feeder with castor oil, and put it on the trav above the firebox door to get hot. Then you fill your gage glass and open the cocks, and let it gradually work into the boiler. The quantity held by one gage glass will be found sufficient to prevent priming on a run of sixty miles, even when the grades are heavy. As soon as priming begins again, you have to repeat the dose. We run on an up grade of 120 miles, and two gages of castor oil are sufficient to keep the engine from priming throughout the whole of that distance.

If you use glycerine, about one-quarter of the quantity will be sufficient. We use castor oil for everything, excepting valves and cylinders, and as it is always on the engine, we use it in preference to glycerine. We had terrible trouble here with priming, on account of the bad water used, until we tried the castor oil; but that has proved a complete remedy.

C. WALKINGTON.

Murray Bridge, South Australia.

A Question About Gages.

Editors:

Is there not a better construction of the dial of a steam gage than the one made by some well-known makers?

Instead of having the pointer travel ¼ inch or less for an indication of 5 pounds, is it not better to have a pointer travel ½ inch, or even longer, for a 5-pound indication?

With a longer pointer movement, could not a fireman tell what effect one or two scoops of coal will have on the steam pressure?

A gage with close markings is continually bobbing back and forth, especially on a flighty engine.

Also the air gage might be made on the same principle.

A. A. LINDLEY.

Oskaloosa, Ia.

An Eccentric Set-Screw Lock.

Editors:

Although the eccentrics of the Fall Brook's locomotives are feathered on the axles if the set screws are lost, they soon become loose and wear out the keys.

The eccentric next the driving box always gives the most trouble, and is inaccessible to replace the screws until forward motion strap is taken down, often causing considerable trouble and delay.

The form of set screw shown in Fig. 1 has been used. This admits of the use of a common nut for a lock, and proves very efficient, besides being cheaper to make than the common kind. A grade of steel is used which can be cut in the dies of a turret lathe, and a full-length bar is threaded at once, and then cut to correct lengths and ends squared in a milling machine.

As shown in Fig. 2, the nut is screwed on after it is set up, and does not add anything to length of screw; thus can be used in close quarters.

F. E. ROGERS.

Corning, N. Y.

First Locomotive with Horizontal Cylinders.

Editors:

In your July number, page 543, you claim that Wm. Mason built the first locomotive with horizontal cylinders and spread truck, ignoring the fact that the "Addison Gilmore" was built two years before Mason built a locomotive, with the above named peculiarities.

W. EDDY.

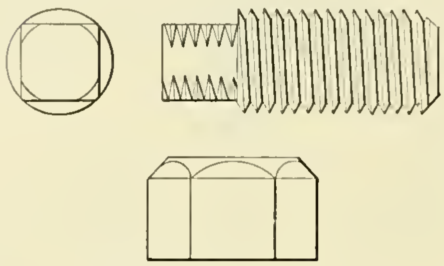
Springfield, Mass.

[We stand corrected.—Ed.]

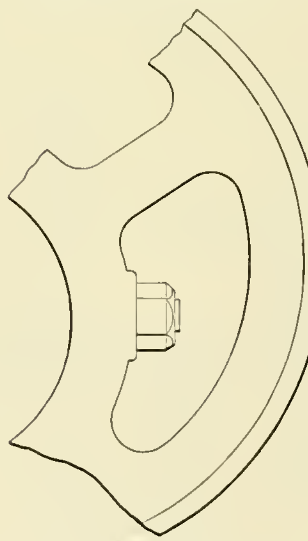
Narrow Escapes.

Editors:

I wish to claim exemption from the rule set forth in "Fatal Accidents," on page 429, June number, in which it is claimed that the third disaster is fatal. I have been in four or five close calls as it may be termed, but I only will mention three so as to show the writer in the June number that we can stand more than three wrecks. On May 9, 1893, we were backing down a grade alongside a river which was very swift (the fall of the river is



SET-SCREW LOCK, FIG. 1.



SET-SCREW LOCK, FIG. 2.

about 1.5 per cent. and the water was high, the stream was running about 15 miles per hour.)

The natural course of the river had been changed by the grate placed across the river bed and a new one dug. The current was too strong and it cut through the dump, leaving the rails hanging in the air. We, without any warning, backed in it, as it was in the darkest part of the night and no head light on the back end of the tank, I went down with the engine and was knocked unconscious in going down, but soon gained consciousness and was washed ashore without much injury. I was firing this engine. The engineer also escaped with little or no injury.

The following winter I was firing an engine on the passenger run, when one night the snow was drifting badly. The snow train, consisting of a rotary plow, locomotive engine and way car, ran ahead of us to open the road for us. It was overtaken by us and as the rotary was not worked between snow drifts, the smoke trailed down behind the way car and we could see no red lights, so we smashed into the way car and knocked it in small pieces. The engine I was on turned over and went down the dump, but we were not injured, both of us staying with the engine until it was laying still. We got another engine and brought our train over the division.

Then last winter I was double-heading a passenger train with a snow plow on my engine when in striking a drift the plow made for the top, thus throwing the engine off and down the dump to clear. The tank on my engine was thrown on top of the engine and everything about was crushed in, but the place were I was, which was not any too large for me. All this was done so quick that I had no time to jump and I was not injured in the fall. I was running this time.

C. G. WYBERG.

Kalispell, Mont.

Locomotive Reminiscences.

Editors:

In looking over Locomotive Chart No. 6, in the June number of "Locomotive Engineering," the writer of this article came across a couple of old friends—the first "Consolidation" and the first "Decapod" locomotives built in the world. These locomotives were built at the "Norris Locomotive Works," Lancaster, Pa. The Brandt Locomotive Works were started in Lancaster, Pa., about 1854. It was a stock company, operated by citizens of Lancaster, John Brandt, Senior, being its superintendent. These shops were operated until the panic of 1857, when they closed down on account of not being able to collect from the different railroads that had bought locomotives from them. The Pennsylvania Railroad had a great many of these locomotives, and a great many were sent West and South.

In the winter of 1863 and 1864, after the United States Government had closed down the Richard Norris shop in Philadelphia, for refusing to do Government work, Edward and James Norris, two brothers of Richard Norris, came to Lancaster, and leased the old Brandt shop for a number of years. They afterwards bought this shop for $45,000. The writer of this article went in these shops as an apprentice in October, 1865. At that time Fred Curie was superintendent and John A. Durgin was chief draftsman. In 1866, Mr. Durgin was appointed superintendent and constructor. He constructed the first consolidation locomotive. I do not remember the exact number built at that time. The next year he constructed the first decapod locomotive. There were two of them and they were called the "Bee" and "Ant." There were other consolidations built at these shops, and if I remember rightly, there were two more decapods built on the plans of John Milholland, of the Cumberland & Pennsylvania Railroad. These shops were closed down, in November, 1868, on account of the failure of the Norris Brothers. Mr. J. A. Durgin then went to the Pittsburgh Locomotive Works, as general superintendent, from there he went to the Rhode Island Locomotive Works as general superintendent. From there he went to Europe, Old Mexico, and made a trip through the United States. He was then appointed master mechanic on some road in the East, and was afterwards killed by being caught between two cars in going through the yard.

Perhaps some of the readers of "Locomotive Engineering" can tell me if there are still any of the Brandt locomotives in existence yet. During the "Centennial Year," the writer saw one running on passenger trains between Harrisburgh and Philadelphia. It was No. 188, and in the early days when the locomotives were all named, this one was called "Fingal's Baby," after a well-known "Irish Giant."

When the writer left the Pittsburg, Cincinnati & St. Louis Railway, January, 1881, there were still four of the Brandt engines running on the Pittsburgh end. But they were broken up about 1885.

HENRY C. FRAZER.

San Francisco, Cal.

The Empire State Express' Fast Run Beaten.

Editors:

In the August number of "Locomotive Engineering" I noticed the account of the fast run made by the Empire State Express, on the New York Central, July 16th. The second paragraph of the article reads as follows:

"The fastest time was made from the top of the hill west of Batavia to East Buffalo, which is 32 miles run, in 26 minutes, which is very close to 74 miles an hour. Such a speed for the long distance is unparalleled."

On October 24, 1895, a special train was run over the Lake Shore and Michigan Southern Railway from Chicago to Buffalo, the record of which run I herewith inclose.

The greatest speed was attained between Erie and Buffalo Creek, a distance of 86 miles.

Some of the remarkable features of this run are as follows:

Maximum speed attained, 92.3 miles per hour.

Eight consecutive miles at the rate of 85.44 miles per hour.

Thirty-three consecutive miles at the rate of 80.6 miles per hour.

Eighty-six consecutive miles at the rate of 72.91 miles per hour.

You will see that the 33 miles were covered at a speed of over 6 miles per hour more than the 32 miles between Batavia and East Buffalo, on the New York Central; consequently, the run made on the latter road is not unparalleled.

The engine which made this run was a ten-wheeler, designed by Mr. G. W. Stevens, superintendent of motive power, and was built by the Brooks Locomotive Works. The cylinders are 17 x 24 inches, and the drivers are 68 inches in diameter.

My object in writing this letter is not to detract from the really remarkable run made by the New York Central, but I thought that you would be glad to make the correction, if the error was pointed out to you.

CHARLES D. WRIGHT.

Cleveland, O.

Rejuvenating 17 x 24 Power.

The small boiler trouble is being subjected to a straightening out by Superintendent of Motive Power Quayle on two 17 x 24 engines that were suffering from too much cylinder and too little steam. New cylindrical parts were built to fit new boiler heads and throat sheets furnished by the Schenectady Locomotive Works. The new boilers are 56⅛ inches diameter at the small ring, of 9-16 inch steel. Tubes are 243 in number, 2 inches diameter and 12 feet in length. The fire boxes are 32⅝ inches wide, and 74 inches long at the mud ring. The boilers are designed for 180 pounds pressure, and with the 69-inch wheels going with these engines there is every reason to predict a service out of them that will argue well for the abandonment of the old 48-inch evaporators they are to replace. The discarded boilers are applied to 15 x 24 engines that are suffering from the same complaint as those referred to above.

How to Make Light Repairs on the Locomotive Boiler.

BY HENRY J. RAPS.

We will assume that the boiler has been cared for properly—has been washed out at regular intervals, say every 500 or 600 miles. All unusual accumulations of scale have been taken care of. The stay-bolts and crown-bar rivets or radial stays have not caused any trouble, but the tubes are becoming troublesome, they will not remain tight more than a trip or two. If the tubes are close together, say ½ inch to ⅝ inch, this will take place from 10 to 12 months after boiler is put in service. If tubes are from ⅞ inch to 1 inch apart, they should not give any trouble for from 1½ to 2 years—the closer together the tubes are, the faster they will fill up with scale.

You may possibly worry along with the tubes in this condition for a year or two longer, but it is not good policy to do so; there is no money in it, only a lot of grief for the engineer and fireman, for the officials and also for the boiler-maker.

As scale accumulates in sufficient quantity to cause the tubes to leak, particles of coal not only adhere to the tube-sheet, but also to the tubes, partially or wholly closing them and impeding the draught. The cinders passing into the tubes are saturated with moisture from the leaky tubes, the moistened cinders adhere to the inner portion of tubes, closing them up, and reducing the amount of heating surface—making it impossible for the fireman to keep up steam—reducing the efficiency of boiler and engine.

True, this can be partially remedied by cleaning the honeycomb off from the tubes, but in this case prevention is worth more than the cure.

The water from the leaky tubes is constantly running over the tube-sheet, corroding it and making it brittle. It also corrodes the stay-bolt heads and eventually causes them to leak, also causing the sheet to crack at the stay-bolt hole. The repeated caulking of the tubes wears away the bead, and in a short time a groove is worn into the sheet by the caulking tool. The constant extraordinary expansion of the tubes on account of the formation of scale has made the tubes brittle and eventually the beads crack off, making it necessary to insert a copper thimble and plug. These will remain tight for a short time. When they leak it is necessary to caulk them with a beading tool, which gradually cuts away the copper thimble; the result is that the beading tool cuts into the sheet deeper and deeper, until it is distorted and nearly cut through.

The expansion and contraction of tube-sheet on account of scale also causes the sheet to crack through the bridges, and its general condition, when engine is brought in for repairs, is such that it is unfit for further service, and its removal follows.

But this is not the most expensive part of allowing tubes to run beyond their safe limit, sooner or later your superior is likely to thrust a message under your nose something like the following:

........Station.

Had to double .... hill account of tubes leaking, laid out 45 minutes.

........Engineer. Engine No. ..

When the engine comes in you have an extra good job done on tubes, and they do tolerably well for three or four days, when you receive a message something like this.

........Station.

Had to set out eight cars, account of tubes leaking; obliged to plug four tubes.

........Engineer. Engine No. ..

Still you trust to luck and try it again. The engineer starts out with a full train; he proceeds twenty miles, and wires back that he has lost fifteen minutes, account of tubes leaking; engine wouldn't steam. He is obliged to set out four cars. He goes another twenty miles, and again wires saying he has lost one hour plugging tubes. He is obliged to set out five more cars.

At the end of the next twenty he wires that he is unable to proceed farther with train. He is instructed to return with light engine, and has covered half of the distance, when the official is startled by the following:

........Station.

Cannot proceed farther; tubes very bad; cannot keep water in boiler.

........Engineer. Engine No. ..

Very likely you are feeling very sore yourself about having all this odium cast upon the boiler-shop, and you wish to remedy the trouble.

In the first place, have the tubes in all the boilers tested with a hammer to find out their exact condition in regard to the formation of scale and the amount formed; repeat it every six months (oftener if found necessary); keep a record of each engine, noting date, condition of tubes and number of tubes necessary to be removed to clean out scale from between tubes. Have roundhouse boiler-makers report any unusual leakage, also any troublesome accumulation of scale.

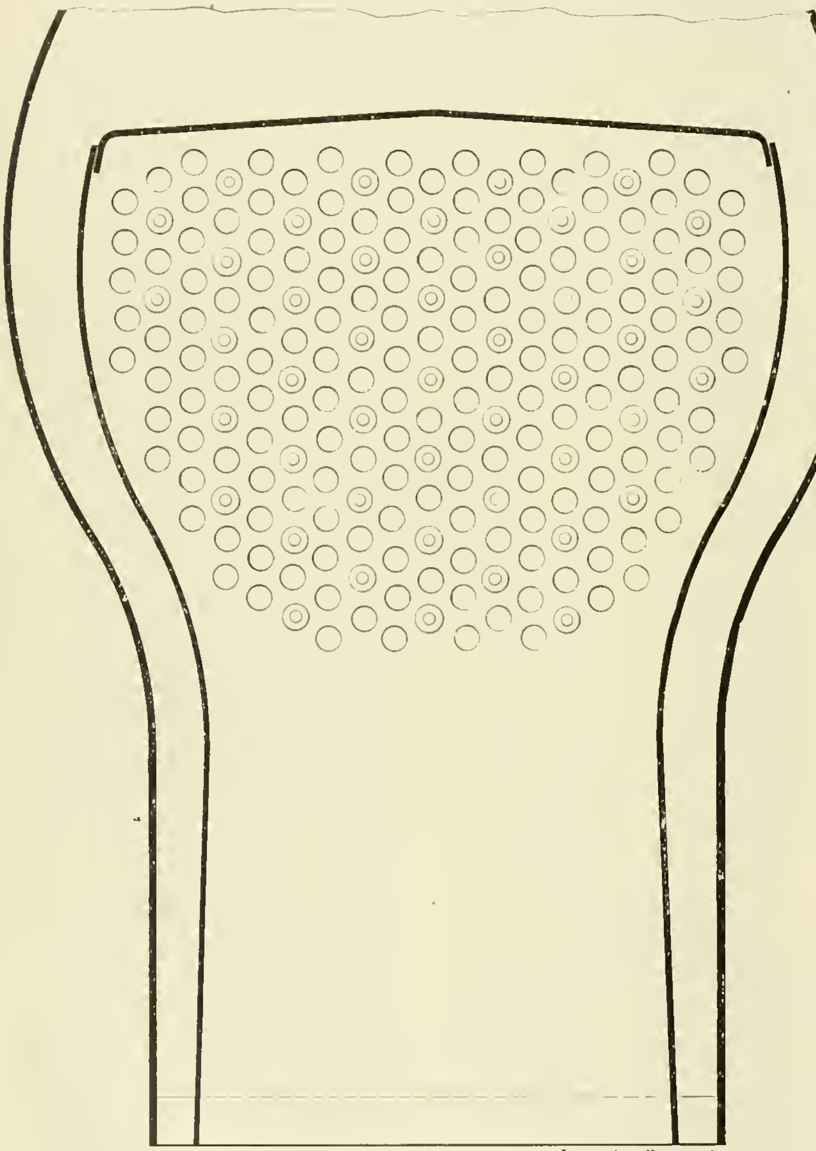


DIAGRAM SHOWING TUBES TO BE REMOVED.

It is necessary to tow engine in—a complete failure.

This is invariably the outcome of allowing tubes to run beyond their safe limit, and it is this sort of grief that causes railroad officials to exclaim: "How long is the destiny and welfare of this road to be controlled by the boiler-shop? And what will be the final result? Will it be bankruptcy?"

When the tubes are likely to make trouble—not after the trouble has been made—remove a sufficient number to clean the tubes and shell. The usual manner is to remove an inverted V-shaped section from the bottom of tubes—taking out fifty or sixty—more than the necessary number of tubes are removed without accomplishing the desired result—the removal of scale between the tubes.

A far better plan is, to take out every other tube in each alternate row, as marked by small circles in illustration shown below. It will readily be seen that it is possible by this method to remove all the scale between the tubes—accomplishing the purpose for which they were removed.

It may not be necessary to remove all the tubes marked; the illustration merely shows the plan which should be followed.

It will not be necessary to remove steam pipes; nozzle only should be taken out. It may be necessary to remove a few extra tubes on either side, in order to shift the outer tubes over far enough to clear steam pipes.

Should engine have circulating tubes, it will be necessary to remove one in order to take out and replace tubes conveniently. Possibly one of them is in bad condition and needs to be renewed; this one should be taken out, as it makes no difference which one is removed, as far as taking out tubes is concerned.

If the tubes have not been allowed to run too long, the scale may be removed in a few hours, otherwise it may take 1½ to 2 days, and even then it is much less expensive than to allow the tube-sheet to deteriorate to such an extent as to cause its renewal, or the engine to fail causing grief and disappointment all along the line.

In washing out avoid filling the front water-leg with scale, as it is very hard to dislodge, when once packed in solidly.

At this time crown sheet, water-legs and stay-bolts should be inspected and all scale removed. Grate bars should be removed and all leaks about mud ring attended to. Rust and ashes should be cleaned off from mud-ring rivet heads, and those that have leaked should be caulked. All leaky wash-out plugs should be taken out, holes retapped, plugs chased and replaced.

Should it be necessary at this time to remove dome-cap and stand-pipe in order to clean off crown-sheet, all braces and brace pins which are accessible should be tested and thoroughly inspected, and those that are cracked, broken or dangerously corroded removed and new ones put in place.

These will likely be all the defects requiring attention, except possibly a crack or two in the bend of door-ring, on account of too much lap on inner flange; if there are such, they should be drilled out, the hole tapped and an iron plug inserted, care being taken that not more than one or two threads of the plug project through the sheet.

If there is a stud hole in back-head through which plug can be held on, it should be utilized for that purpose, and also to upset plug from the inner side with a steel pin. If there is no such hole, the plug should be lightly fullered and caulked.

At this time the stay-bolts should be

tested to find out if any are broken or cracked.

The inspection of stay-bolts is a very important feature in the care of the locomotive boiler. Various methods are employed to discover broken bolts, with good, bad and indifferent results.

On some roads 30 to 40 pounds pressure is put on the boiler with compressed air or steam, after letting out water, in order to force the ends of the broken bolts apart. This aids slightly in discovering broken bolts; but it will never help you to find a cracked bolt, which is the more dangerous of the two, as it is liable to be overlooked in testing bolts.

Should the stay-bolts in upper part of box become cracked half way through, which is not a rare occurrence, it certainly reduces the strength of that portion of the bolts 50 per cent., which is extremely dangerous; for should they all break simultaneously, which is liable to occur, the result may be an explosion.

Some years ago on a certain railroad there was a standing order to test bolts once a week; the usual practice is from thirty days to six months, some putting it off until engine is brought in for general overhauling. Testing bolts once a week is extremely careful, and waiting until engine comes in for repairs is extremely careless and dangerous.

A boiler which is properly constructed and has a sufficient number of stay-bolts made of the best iron, need not be inspected oftener than once every six months, provided that all broken and cracked bolts are renewed when found.

Boilers not having a sufficient number of stay-bolts should be inspected oftener, but as this manner of inspection is liable to create confusion, a safe limit shou'd be set for the weakest boiler (unless it is re-enforced) and all boilers tested under that limit. The jacket should be raised at regular intervals and the inspection made as thorough and systematic as possible. A record should be kept showing date of inspection, condition of bolts, number and size of bolts taken out and put in, kind of material, mileage and name of inspector.

The ordinary way to test stay-bolts is to let out the water and have them held on on one end with a light sledge and tap them on the other with an ordinary chipping hammer, and judge from the sound which ones are broken or cracked.

A broken bolt which has its two ends separated is very easily detected by the hollow sound which is emitted when the bolt is tested. A broken bolt whose ends are still in contact can be detected by the dull, vibratory sound emitted; a cracked bolt will have the same sound but not so pronounced, depending on how badly it is cracked.

It is impossible to detect all bolts that are cracked by the sound test.

It is this fact that makes the sound test unreliable, and therefore unsafe, and too much dependence should not be placed upon it.

Since the demand for higher pressure by railroad companies, more attention has been paid than formerly to the design and construction of the locomotive boiler. Unsafe and questionable practices have been abandoned for more advanced methods, which experience, common sense methods of calculation and tests have proven to be safe. In many instances the care of the locomotive boiler has not kept pace with the advancement made in its construction; this is especially true of testing stay-bolts.

If higher pressures demand better construction than formerly, they surely also demand the best of care, therefore all unsafe and questionable practices should be abandoned for those that are absolutely safe.

By far the best method of testing stay-bolts is to drill a 3-16-inch hole 1 inch deep in their outer end, and when they crack or break they will report themselves. When they do report themselves, they should not be plugged, but taken out and replaced with new ones. Don't establish a bad precedent by allowing a cracked or broken bolt to remain in the boiler. Bad precedents are usually easier and more liable to be followed than good ones, and loose methods, if continued in, will eventually make careless men; careless men may bring disaster.

In a busy season, when locomotives are in almost constant service—making it very inconvenient to hold an engine to have broken stay-bolts removed—a small number of broken solid bolts are sometimes allowed to remain in the boiler. There are only a few, and will do no harm; they will be taken out as soon as the rush is over. But the rush sometimes continues; new duties demand and receive attention, and the bolts are forgotten until the boiler-maker brings in a forcible reminder in the form of a report saying that the upper part of one of the side-sheets has a bulge in it the whole length of fire-box and 8 inches or 10 inches wide—the result of all the bolts in two or three of the upper rows being broken.

It sometimes happens that broken, hollow or drilled bolts are plugged when an engine is badly needed.

These are very bad practices, and cannot be too strongly condemned. It is fortunate, indeed, if such indifference and carelessness does not make procrastination the murderer of men as well as the thief of time.

Simple Tests for Oils.

A little chemistry will also help in selecting and testing lubricating oils, and the following may be useful to some. I speak here of hydro-carbon or mineral oils. The color of the oil should be perfectly clear, as cloudiness indicates the presence of water or excess of paraffine. When treated with an alkali it should not saponify. If it does it is mixed with animal fats. To detect acid or alkali, wash a sample of oil with distilled water. Draw off the water and add to it a few drops of phenolpthalein; if it turns a red color the presence of alkali is indicated. If a piece of litmus paper, dipped into water, changes color, it is a sign of acidity. Next take a sample and add a little sulphuric acid, which should give a yellowish brown color only. Should it darken or blacken the oil, or increase the temperature considerably, it indicates a low grade oil, mixed with resin and fat oils. Exposed to a temperature of 200° Fahr. it should not lose weight.

Iron Felt.

Berlin and Leipsic are boasting about a new invention, to be known as iron felt. It is made of the very best woolen materials, impregnated with the inventor's patented preparation, which gives it a great power of resistance. It is said to be very useful for railroads of all kinds. Placed between rails and sleepers, it deadens sound and prevents shocks. The first experiments with the new material were made by the Berlin City Street Railway, over which 360 trains pass daily. The results surpassed the company's most sanguine expectations. Not only was the noise brought down to a minimum, but the wear and tear was materially diminished. It is to be tried on new roads at Leipsic. Such an insulating material seems to be specially adapted for elevated roads.

The Knot.

We frequently receive letters asking the length of a knot, the measurement generally employed in telling the speed of seagoing vessels. Few of our landsmen ever learn the length of a knot, and those who have done so at school, do not carry the particulars on their memory; so we will give a note defining the knot, to be cut out and pasted in the memorandum books of people interested in the speed of ships.

A knot, or nautical mile, varies with the latitude, but the United States authorities have adopted 6,080.27 feet as its constant length. The English Admiralty, on the other hand, calls 6,080 feet the knot, or nautical mile. The word "knot" originated from the knots which form the divisions of the long line used by mariners.

A simple rule for converting knots into miles is to multiply by 1.1516.

Mr. Webb, the famous locomotive superintendent of the London & Northwestern, has lately built two particularly heavy passenger locomotives—one simple, the other compound. Both have Joy's valve gear.

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Counterbalancing Locomotive Driving Wheels.

There has been so much said and written about the counterbalancing of locomotive driving wheels that it might be considered the subject was exhausted, but there is always something happening which gives the theme new vitality, and revives anew the discussion on the practicability of building a locomotive that can project with lightning rapidity its heavy reciprocating parts and swing its immense revolving weights without destructive effects upon its own parts or upon the track. The discussion of the subject has again been revived by experiments made at Purdue University with a four-cylinder locomotive described elsewhere in this paper and by another report on locomotive counterbalancing submitted to last Master Mechanics' Convention.

The first locomotives that were used in the operating of railroad trains were so light that the disturbance from the motion of the reciprocating parts and of the crank attachments was so small that the engines worked fairly well without any counterbalance in the driving wheels. As weights began to increase, however, it soon became apparent that something must be done to neutralize the fore and aft jerking induced by the crank pin connections, which caused an extra pull when they were moving forward and a backward push when they were moving towards the train. The obvious remedy for this was to place weights in the driving wheels opposite the crank pins. The practice of putting counterbalance weights into the driving wheels was scarcely begun when engineers and designers commenced to dispute about what was the proper proportion of weight to be used, and great conflict of opinion still exists on this question, although the American Railway Master Mechanics' Association have established rules to be followed.

Until the rules referred to were formulated the leading railroad companies and locomotive builders followed rules of their own for counterbalancing locomotives, and the weights employed were considered satisfactory if the engine rode well and was free from the evil habits of jerking, nosing, galloping, pounding or rolling. But as weights of locomotives kept increasing it was discovered that an engine might be free from the disturbing actions mentioned and yet be possessed of very grave characteristics. The counterbalance weight was required to counteract or minimize the strains and vibrations caused by the momentum or inertia of the moving parts attached directly or indirectly to the driving wheels. These are of two kinds, revolving parts and reciprocating parts. The revolving parts could be counterbalanced with exactness by weights inserted in the wheel, but the reciprocating weights could only be balanced in one direction by adding weights to the driving wheels, as all weights added after the revolving parts are balanced overbalance the driving wheel vertically.

Overbalanced driving wheels do not assert themselves to a man riding upon a locomotive as the extra weight tends to improve and smooth the motion of a locomotive, so it was not surprising that this excess of weight was carried to a most pernicious extent. Engineers in charge of track and bridges began to protest against the destructive effect that the heavy counterbalance was exerting upon their structures, but little attention was bestowed upon their complaints until fifteen or sixteen years ago, when Mr. John W. Cloud read a paper before an engineering society, in which he demonstrated that the excessive counterbalance inflicted upon track and bridges a recurring pressure, which he called a "hammer blow." The expression in itself appealed to mechanical men more forcibly than a long lecture on the danger of too much counterbalance, and the railroad engineering world began to devise means for making a smooth riding engine that would not exert a serious effect upon rails and bridges.

One of the first results of this agitation was the building of the Shaw locomotive which had four outside cylinders with their connections so arranged that the reciprocating parts balanced each other. A great deal of expense and energy were devoted to urge that type of locomotive into favor with railroad companies, but no success was achieved. No man who could figure the effect of moving forces doubted that the Shaw locomotive overcame all the objections urged against the ordinary locomotive on account of its hammering tendencies, but no railroad company adopted the engine. Now the Strong locomotive has been tried and found equal to all the merits claimed for it, and is proved to be a perfectly balanced locomotive, but we have very small expectation that it will exert any material influence on the design of our future locomotives. Railroad men are too conservative to favor the radical change which the Strong locomotive calls for, but we believe that an engine of that type would prove a paying investment before it was worn out. It would certainly be a remedy for the evils of bent and broken rails, and the crossing of weak bridges would be done with much less risks than are run at present. Then the internal shocks and strains must necessarily be greatly reduced, which would tend to keep down the cost of repairs. There are some features of the engine that we consider of doubtful utility, but there is no doubt that the balancing features cannot be commended too highly, even though they entail the use of a crank axle.

The Coming Good Times.

There is a great deal of talk about the improved condition of business, but the best testimony that things are really on the mend has come, within the last ten days, from representatives of leading locomotive and car-building works. Both made the statement that orders are offered more freely than they have been since the depression in business began, but the embarrassing part of the situation is that the would-be purchasers require delivery within a month. There are few locomotive or car builders with any work on hand who are able to meet these conditions, and the railroad companies who have delayed ordering rolling stock, until the pressure of hard need was upon them, will have to possess their souls in patience and wait for new locomotives and cars, while their rivals are taking the extra share of business which superior foresight has made them able to handle.

For the first time in four years we have seen reports in the Associated Press despatches that a car famine is existing in certain regions, and that in other sections the side tracks are congested with loaded cars waiting for locomotives to move them. It is a pity that all the railroads should not be ready to increase their earnings to the extent of the business offering, and by that means draw upon the idle hands who have been so long waiting for employment; but the railroad managers are not to blame for the dilemma which has overtaken them. Improvement in transportation business nearly always comes slowly in the wake of improved manufacturing conditions; but, through a series of unforeseen circumstances, the improvement in transportation requirements has this year gone ahead of what has usually been the leading cause. There are a few more factories in active operation to-day than there were a year ago, and reliable accounts of cold furnaces going into blast have been received, but the increased production has not been sufficient to increase railroad earnings to an appreciable extent.

There are some people who are always looking to interference with the natural laws of business to bring about improved and prosperous conditions. The prevailing improvement provides a good lesson of the real causes that bring about good times. For three or four years our farmers have been sowing and reaping as usual, but drouth in some sections and excess of moisture in others have caused short crops; while the farmers in most other countries, who labor to raise the world's supply of bread, produced abundant crops. This year our farmers are raising abundance of wheat and corn, and those abroad in the principal food-raising countries are short. That is really the secret of our improved transportation conditions. When the crops are moved, it is to be hoped that the wheels of general industry will be turning at a rate to keep up prosperous conditions until overproduction or under-consumption brings the next depression, which seems inevitable under existing industrial and social conditions.

The Safety Appliance Act.

On March 2, 1893, a bill known as the safety appliance act became a law. By the provisions of this law it was necessary that all railroads should have their rolling stock engaged in inter-state traffic equipped with automatic couplers and air brakes by January, 1898. The wildest fever of anxiety pervaded railroad circles for a time until it spent itself for want of material to feed on and finally died away, until the apathy on the subject became as well marked as the previous excitement.

Inquiry fails to show any concert of action. While many are preparing against the fateful day when a fat penalty will go with each violation of the provisions of the act, there is so little heard of any effort whatever in other quarters that it appears that somebody has an abiding faith in an extension of time before the penalty became operative. Cars without air, and having a brake on one truck only, are frequently seen here in the East far away from home. Of course these cars will be taken out of interstate traffic when they become amenable to the penalty, but it looks a little dishonest to see so many of their kind foisted on the other fellow who must see to it that his trains are made up so as to comply with Section 1 of the enactment which requires that a sufficient number of cars in the train shall be so "equipped with power or train brakes that the engineer on the locomotive drawing such train can control its speed without requiring brakemen to use the common hand brake for that purpose."

There seems to be a sentiment abroad, and it has found quite a secure lodgement among those that would have it so, that there will be ample time given to delinquents on a proper presentation of the causes of inability to comply with the law. We believe that such will be bitterly disappointed in the final round-up. Those who are bending every energy to meet the requirements of the act at this time, will find themselves no more than well in out of the wet in the few remaining months now left to finish up the work in hand.

The Traveling Engineers' Convention.

The Traveling Engineers' Association, which meets in Convention at Chicago this month, is doing as valuable work for the promotion of railroad interests as any organization ever formed. The association was organized in the office of "Locomotive Engineering" in January, 1893, its object being to "improve the locomotive engine service of American railroads." No association of men ever proceeded with more energy and intelligence to carry out the purpose for which it was formed.

We consider that there is no official in railroad service who can do so much to keep down operating expenses as the traveling engineer, if he is the right man in the right place. In the few cases where the office of traveling engineer has proved a failure they were invariably due to the choice of individuals who were not adapted to performing the varied, delicate and difficult duties required of a successful traveling engineer. He has to stand in the midst of a conflict that wages more or less on all railroads, with the officials on one side and the enginemen on the other, and the harmony of the service depends to a great extent upon his tact and judgment. He must be familiar with every detail of train mechanism, and be able to diagnose promptly the cause of all failure and disorders, he must be as good an engineer as there is on the road and he must be competent to take hold of the scoop and show an incompetent fireman how to do his work with the least possible expenditure of fuel. When an engine is not steaming properly he must be able to detect the cause and point out a remedy, he must be a judge of all the supplies used in locomotive service and a competent critic of those that are not satisfactory.

For men performing such varied and responsible duties experience meetings are extremely valuable. The annual convention constitutes the best kind of an experience meeting. Papers and reports are read and discussed just in the way that other associations carry on investigations of subjects in which the members are interested, and the Traveling Engineers have been exceedingly happy in the choice of subjects. If the reading of reports and discussing them together were all that is done at these conventions, the work would be of substantial benefit to the members and their employers, but there is a great deal of unrecorded work done which is quite as valuable as the public transactions. This is in the form of quiet private talks wherein members exchange experiences and tell how difficulties have been overcome and misunderstandings cleared up.

In connection with this coming meeting we wish to appeal to the officers in charge of the traveling engineers to see that no obstacle is permitted to stand in the way of their men attending the convention. Business may be unusually rushing, but it will not suffer if the hard-worked traveling engineer is permitted to be absent for a few days, and his presence at the convention will help to lubricate his work during the year that passes before the next one comes round.

Engineers Purchasing Oil Lubricants.

Two correspondents, writing in the August number of the "Brotherhood of Locomotive Engineers' Journal," draw attention to a practice of engineers purchasing tallow for their engines, which is becoming common on certain railroads in Alabama, so that they may appear to run with extraordinary economy of lubricants. We consider that the men who do such a thing are exceedingly foolish, and that the railroad officers whose policy makes a sentiment of this kind strong are pursuing a course which is likely to prove in the end very expensive to the company. Stinting the oil necessary to keep bearings and rubbing surfaces well lubricated is the most ruinous form of dear cheapness that we are acquainted with. The hard times have kept up such a persistent demand for reduction of operating expenses that all methods of saving have long been exhausted. This is no doubt the reason why attempts are yet common to still further reduce oil bills. If a superintendent, by never-ending preaching to the enginemen, succeeds in reducing the cost of oil one cent per train mile, he thinks that he has done a wonderful feat of saving, but he fails to inquire into the increased cost in other directions. He does not realize the quantity of extra coal that has been burned to overcome the increased friction due to hot boxes, dry valves, groaning pistons and unlubricated parts generally. Very small trouble from dry bearings will waste in price of coal twice the possible saving in oil, and then it leaves a serious aftermath of increased shop repairs.

The average engineer is as careful in the use of oil as he can well be, consistent with keeping the bearings properly lubricated. There is one species of nervous man who, through force of habit, oils the bearings at every stopping place, without consideration of what is needed. This individual waste frequently gives the officials the impression that engineers generally are too liberal with the oil-can, which is not true. Because one or two men are in the habit of keeping the roadbed well anointed with oil, sweeping orders are issued to reduce the supply. It is the spigot kind of saving.

Report of the Proceedings of the Thirtieth Annual Convention of the American Railway Master Mechanics' Association.

This report has been published with commendable promptitude by Secretary Cloud, and the work of getting it prepared has not been slighted, for the discussions have been carefully edited, a good index inserted, and the mechanical work remarkably well done. It forms a book of 337 pages of the standard size, bound neatly in half morocco.

The report constitutes papers and discussions on the leading mechanical topics that are occupying the minds of railroad men. There are reports and discussions on Apprentice Boy; Air-Brake and Signal Instructions; Best Metal for Cylinders; Boiler Jackets; Counterbalancing Locomotives; Locomotive Grates; Ratio of Grate, Heating and Cylinder Volume. There were also discussions on Broken Staybolts; Causes of Irregular Wear of Cylinders; Compound Locomotives; Cylinder Clearance; Exhaust Nozzles and Steam Passages; Lead for Locomotives; Manual versus Automatic Control of Compound Features; Piece-Work in Locomotive Shops, and a variety of others.

To one who has attended the Master Mechanics' Conventions for years, there is noticeable a striking difference in the character of the reports submitted to the thirtieth convention and those that were presented in the early history of the association. The early reports consisted of facts collected by purely practical men and opinions or deductions based upon these facts. The reports were prepared with little scholarly finish, and the discussions were confined to a small circle, and were the expressions of men more familiar with the shop floor than with the floor of debate.

A change has been gradually going on within the association, and most of its reports are now prepared by scientific engineers whose modes of expression would have been unintelligible to nine-tenths of the members ten years ago. The discussions are now spread over a large portion of those present at the meetings, and are noted for the fluency and readiness of the speakers. The change is not all gain, but it fairly indicates the trend of progress in the mechanical departments of our railways. The scientific engineer is pushing in front of the practical mechanic. Those ambitious to become superintendents of motive power must acquire familiarity with scientific engineering, or they will have small prospect of success in their aim. The report can be purchased from John W. Cloud, Rookery, Chicago. Price $1.50.

BOOK NOTICES.

"Accidents and Emergencies," by Charles W. Dulles, M. D. Published by P. Blakiston, Son & Co., 1012 Walnut street, Philadelphia, Pa. Price, $1.

This is a book of 166 pages, 5 x 7½ inches, and the fact that it has reached its fifth edition shows that it has been appreciated. The language is clear and easily understood, and the suggestions cannot fail to prove of value to anyone who has to do with accidents—and who has not? The book covers quite a wide field in small space, gives illustrations where necessary, and as there is a chapter devoted to domestic emergencies, it can be said to appeal to all classes, whether they are railroad men or not. We are sure this book will be well worth the price to anyone, and a copy should be kept handy in all shops or other places where the work is at all dangerous.

"The World's Rail Way; Historical, Descriptive, Illustrative." By J. G. Pangborn, New York. Sold by Angus Sinclair Company, publishers of "Locomotive Engineering." Price $7.50.

In a recent issue we laid before the readers of "Locomotive Engineering" a brief history of this magnificent book; we now propose saying a few words about its contents. The work is purely historical and traces the rise, growth and progress of railways the world over, the text being illustrated by numerous engravings of the most artistic character, produced in different colors. The greater part of the engravings are pictures of locomotives, showing the growth of this kind of engine from its earliest conception to the magnificent machines of to-day; but a variety of other subjects relating to railway history are also illustrated. The growth of the permanent way from the single wooden rail to the best types of modern steel rails may be read from following the engravings just as easily as from reading the text. So with the development of the car. It is shown from the most primitive form used in early days, to the modern palace day-car. There are nineteen portraits of men who deserve to be honored for their successful labors in the cause of railroad development.

The book is written in a remarkably clear narrative style, the great mass of historical facts put at the disposal of the author being succinctly digested and well arranged. Owing to his official connection with the Transportation Department of the Columbian Exposition, Major Pangborn enjoyed extraordinary facilities for securing accurate information concerning the growth and development of railways. Records, drawings and documents long jealously hidden from the public eye, were freely submitted to his care, and he made good use of the opportunity to give a clear and reliable history of railways and their equipment. The thorough manner in which the work of collating information was done may be judged from the fact that the author wrote over eight thousand letters in connection with it. The book reads like a novel, and the reader is carried on through the record of the inventions that built up the modern railway, as if it was a narrative of heroic deeds and hair-breadth escapes.

The paper, printing and binding of the book are the best we have ever seen. The paper is of the finest plate quality, admirably adapted for the beautiful engravings so profusely dotted through the pages; the type is noted for its clearness, and the binding is of velvet faced leather, which looks better than morocco. The book makes a very attractive ornament for a library or drawing-room table.

Cassier's Massive Number.

The August issue of "Cassier's Magazine" is called the "Marine Number," being devoted entirely to marine engineering. There are in its 300 pages eighteen articles by well-known men, among them being Sir William Henry White, Sir Charles W. Dilke, A. F. Yarrow, John J. Thornycroft, Robert Caird and others whose names are known on both sides of the Atlantic; Great Britain being well represented, as will be seen. The illustrations (and there are over 300 of them) are good, and interest anyone whose tastes lie in this direction. This number is sent postpaid for 50 cents. Send to the Cassier Magazine Company, World Building, New York.

The Sixteenth Annual Edition of the Official Railway List has reached our desk. It contains a full list of the chief executive officers of all the railroads on this continent, with good finding list and a variety of useful information for railroad and railroad supply men. It is published by the Official List Company, Rookery, Chicago.

In the course of his interesting article on "Railroading with the Confederacy," Captain Anderson remarks that historians have never done justice to the work done by railroads in the war time. This is not only true concerning the aid rendered to the cause of the Confederacy by the efficient management of the railroads, but it is true in connection with the important work done by the railroads that were used by Union armies. One may often read long histories of certain campaigns without finding a word said about the part performed by railroad men, although it is well-known that the rapid movement of troops by rail aided in the most important way to the success of the operations. Some of the most heroic deeds of the war were performed on both sides by railroad men, but the military writer seldom has anything to say about them. What is badly wanted is a history of the part performed by railroads in the War of the Rebellion. The fighting part has been written and rewritten until it is more than threadbare. A writer who will take up the railroad part will work in what is nearly a virgin soil.

The idiotic practice of making a public show of a prearranged head end collision of locomotives seems to be on the increase. The silly performance has been considered sufficiently important to lead a press agency at Macon, Ga., to wire all over the country the news that an application had been made to the city council for permission to hold an exhibition of that kind this fall. We pity the people who spend money to go to such shows, the more so as the spectacle is not easily regulated. At one of these shows one person was killed and several injured, at another one engine failed to make the expected time, and the crash happened outside of the view of the spectators. The instigators of the proposed collision at Macon are said to be R. G. Stone, general passenger agent of the Macon & Birmingham Railway, and George A. Mcdonald, of the Georgia Southern & Florida Railway. It is all right for these officials to devise schemes that will draw excursionists over their roads, but a collision as a spectacle is a little too suggestive.

The men in charge of locomotives that cross the frontier between foreign countries have frequently been convicted of using places about the engine as receptacles of contraband goods, but the smuggling has generally been done on a small scale. An engineer on a Belgian railway appears to have used his engine for wholesale smuggling. The customs officers lately found under the coal in the tender 10,000 cigars, 10,000 matches and large packages of tobacco and coffee.

PERSONAL.

Mr. J. T. Clark, master mechanic of the Northern Ohio at Delphos, O., has resigned.

Mr. Thomas E. Butterly, master mechanic of the Wabash at Moberly, Mo., has resigned.

Mr. F. Green has been appointed superintendent of the Montana Railroad at Helena, Mont.

Mr. A. C. Deverall has been appointed superintendent of the Great Northern shops at St. Cloud, Minn.

Mr. J. B. Rice, superintendent of the Eastern Railway of Minnesota at West Superior, Wis. has resigned.

Mr. O. O. Winter, assistant general superintendent of the Great Northern at Spokane, Wash., has resigned.

Mr. David Anderson has been appointed master mechanic of the Northern Ohio, vice Mr. J. T. Clark, resigned.

Mr. A. A. Holbrook, general superintendent and purchasing agent of the Wilkes-Barre & Northern, has resigned.

Mr. J. D. Roberts has been appointed superintendent of the Harriman & Northeastern, headquarters at Harriman, Tenn.

Mr. S. King has been appointed master car builder of the Middle and Northern divisions of the Grand Trunk at London, Ont.

Henry S. Marcy, president of the Fitchburg Railroad, died suddenly from a stroke of apoplexy on August 10th, at Belmont, Mass.

Mr. W. T. Backus, for the past ten years superintendent of the Ohio division of the Cincinnati, Jackson & Mackinaw at Van Wert, O., has resigned.

Mr. George Crocker has been elected a director of the Southern Pacific, to fill the vacancy caused by the death of his brother, Col. C. F. Crocker.

Mr. J. L. Hees, treasurer of the Fonda, Johnstown & Gloversville, has been chosen president of the company, to succeed the late James Shanahan.

Mr. K. Sutherland, superintendent and chief engineer of the Dominion Atlantic Railway of Canada, with headquarters at Kentville, N. S., has resigned.

Mr. A. P. Hall has been appointed superintendent of the St. Joseph Terminal Railroad, to succeed Mr. J. W. Starr, resigned. Headquarters at St. Joseph, Mo.

Mr. Nat C. Dean has been appointed Western representative of the Fox Pressed Steel Equipment Company, with office at 1413 Fisher Building, Chicago, Ill.

Mr. I. A. Stearns has been chosen president of the Delaware, Susquehanna & Schuylkill. He was formerly superintendent of the Susquehanna Coal Company.

Mr. P. T. Downs has been promoted to the position of superintendent of the Atlanta & West Point & Western Railway of Alabama, vice Mr. Joseph Herrin, resigned.

Mr. Jesse Fry has been appointed general manager of the San Antonio & Gulf Shore, to succeed Mr. George Dullnig, resigned. Headquarters at San Antonio, Tex.

Mr. W. J. Hemphill, superintendent of machinery of the Chicago, Peoria & St Louis Railway, has resigned to engage in the manufacture of woven wire fence at Jacksonville, Ill.

Mr. R. H. Soule has accepted a position with the Baldwin Locomotive Works to represent them in foreign countries. He will perform duties similar to those done formerly by Dr. Williams.

Mr. Joseph Herrin, superintendent of the Atlanta, West Point & Western Railway of Alabama, has resigned, and will hereafter devote his attention to his lead mining interests in Missouri.

Mr. F. P. Boatman, formerly superintendent of motive power of the Omaha & St. Louis, has been appointed master mechanic of the Columbus, Sandusky & Hocking, with headquarters at Columbus, O.

Mr. G. T. Slade, assistant superintendent of the Eastern Railway of Minnesota, has been promoted to the position of superintendent, with headquarters at West Superior, Wis., succeeding Mr. J. B. Rice, resigned.

Mr. P. Gifkins, passenger traffic superintendent of the Dominion Atlantic, has been promoted to the position of superintendent, taking the place of Mr. K. Sutherland, resigned. Headquarters at Kentville, N. S.

Mr. C. M. Ward has been appointed general manager for the receiver of the South Atlantic & Ohio, with office at Bristol, Tenn. He was formerly general manager of the South Carolina, Charleston, Cincinnati & Chicago.

Mr. A. E. Robbins has been appointed superintendent of the Buffalo division of the Wabash, headquarters at Buffalo, N. Y. He was formerly superintendent of the Toledo division of the Columbus, Hocking Valley & Toledo.

Mr. J. B. Flanders, formerly superintendent of the Cincinnati, Jackson & Mackinaw at Toledo, will in the future be superintendent of the Cincinnati Northern, by which name the Ohio division of that road has been reorganized.

Mr. W. F. Galbraith has been appointed master mechanic of the San Luis division of the Mexican National Railway, with headquarters at San Luis Potosi, Mexico. He was formerly master mechanic on the Rio Grande & Eagle Pass.

Mr. N. Frey, general foreman of the Chicago, Burlington & Northern at La

Crosse, Wis., has been promoted to the position of master mechanic, with headquarters at La Crosse, vice Mr. W. H. Lewis, who went to the Norfolk & Western.

Mr. R. W. Bryan has been appointed assistant general superintendent of the Great Northern, with headquarters at Spokane, Wash., vice Mr. O. O. Winter, resigned. Mr. Bryan was formerly general superintendent of the Kaslo & Slocan Railway.

Mr. George S. McKee has been appointed master mechanic of the Wabash at Moberly, Mo., vice Thomas E. Butterly, resigned. He was formerly master mechanic of the St. Louis division of the Cleveland, Cincinnati, Chicago & St. Louis at Mattoon, Ill.

Mr. George F. Gage, general manager and general freight agent, of the Huntington & Broad Top Mountain, has resigned. As a testimonial of their appreciation of his long and faithful service, the officials of the road presented Mr. Gage with a silver set of 129 pieces.

At a meeting of the board of directors of the Northern Pacific, held in New York recently, the resignation of Mr. Edwin W. Winter, president, was accepted. Mr. Charles S. Mellen was elected director and president, and Mr. D. L. Lamont was elected vice-president.

Mr. H. A. Pike, who has been connected with the United States Metallic Packing Co. for some time past, has been appointed their agent in the Southern and Southwestern territory for the sale of their metallic packing, pneumatic hammers and drills, pneumatic track sander and bell ringer.

Mr. Robert B. Reading, who has been for years general foreman of the Elevated Railroad of New York, has resigned and gone to the Klondyke to make his fortune. Robert was always a highly enterprising young man, and has for several years had leave of absence from the Elevated while in charge of a match factory owned by the Gould family.

Mr. W. W. Wheatly, superintendent of the Southern division of the Brooklyn Rapid Transit Company, has been promoted to the position of assistant general superintendent of that system, with headquarters at Brooklyn, N. Y. Mr. Wheatly is widely known through his connection with the New York Railroad Club, of which he is secretary.

Mr. George F. Copeland has been appointed superintendent and assistant treasurer of the Kaslo & Slocan Railway, headquarters at Kaslo, B. C. He was formerly superintendent of the St. Paul & Duluth and later of the Butte, Anaconda & Pacific. A friend writing of the appointment says: "Mr. Copeland is a first-class, practical railroad man, and one of the kindliest officials to be found in the Northwest."

The Detroit & Lima Northern and the Michigan division of the Cincinnati, Jackson & Mackinaw have been consolidated under the name of the Detroit, Milwaukee & Toledo, and the following officers have been elected: Mr. George R. Sheldon, president; Mr. J. R. Megrue, vice-president and general manager; Mr. C. H. Roser, purchasing agent and chief engineer, and Mr. G. R. Haskell, superintendent.

Mr. John J. Gordon, air brake instructor in the South for the New York Air Brake Co., had a very narrow escape from death last month. He was riding on the engine of a train on the Charleston & Western Carolina Railway, when the train was ditched through a piece of iron being laid on the track. Mr. Gordon was considerably bruised and shaken up, but his friends do not expect any permanent bad effects from the injuries received.

Mr. George Gibbs informs us that we were mistaken in announcing last month that he had accepted a position with the Westinghouse Electric Company. Instead of that, he has been engaged by the Baldwin-Westinghouse interests to look after the electric traction development and to have charge of the design of suitable machinery for this purpose. He is located at the Baldwin Locomotive Works, Philadelphia.

We are pleased to be able to announce that Captain Anderson, of the Chesapeake & Ohio, who wrote us a series of articles some years ago on "Train Running With the Confederacy," is about to resume his writings again. His first article of this series will be found in another part of this paper. Captain Anderson was an actor in some very stirring scenes during the late war, and he possesses the faculty of telling his experience in a most vivid and intelligent fashion.

The Quincy, Omaha & Kansas City and the Omaha & St. Louis have been consolidated, and will hereafter be known as the Omaha, Kansas City & Eastern. Mr. C. E. Soule, superintendent of the Quincy, Omaha & Kansas City at Quincy, Ill., has been appointed superintendent from Pattonsburg, Mo. to Quincy, Ill., and Mr. A. E. Buchanan, superintendent of the Omaha & St. Louis at Stanberry, Mo., has been appointed superintendent from Omaha to Pattonsburg.

Mr. A. Hendee, an old railway master mechanic, and well known to many of our railroad men through his connection with the Westinghouse Air Brake Co. as instructor of train men, has been appointed master mechanic of the Santa Ana Railway of Salvador, with headquarters at Sonsonate, Salvador, C. A. Mr. Hendee was sent to Salvador by the Westinghouse Air Brake Co. to superintend the work of putting air brakes upon the cars of the road he is now connected with.

Mr. W. W. Thompson, who is known to a large circle of railroad men from his connection with the Brooklyn and Chicago elevated railroads, has been appointed superintendent of the Continental Match Factory, Passaic, N. J., to succeed Mr. R. B. Reading, resigned. Mr. Thompson went to be an engineer at that factory about a year ago, and a few months afterwards was promoted to be assistant superintendent, and he now takes his place at the head of the establishment.

Mr. S. R. Callaway has been chosen president of the Lake Shore & Michigan Southern, with headquarters at Cleveland, O., to take the place left vacant by the death of D. W. Caldwell. Mr. Callaway was previously president of the New York, Chicago & St. Louis. After the death of General Caldwell there was a great deal of newspaper speculation about who would be the next president of the Lake Shore. When the talk was at its hight we called on Chairman Vanderbilt's office to make inquiries. No positive information could be obtained, but we were told that Mr. Callaway was likely to be chosen. "Of one thing you may be certain," said the gentleman, "the appointment will not go outside of the Vanderbilt system of railways. We have too many good men to choose from to go outside."

EQUIPMENT NOTES.

One engine for the Georgia Railroad is being built at the Baldwin Locomotive Works.

The St. Charles Car Company are building one car for the Keokuk Poultry Company.

The Canadian Pacific Railway Company are having 500 cars built by the St. Charles Car Company.

Two cars are being built for the Canda Cattle Car Company by the Ensign Manufacturing Company.

H. K. Porter & Company are building one 8-wheel engine for the Oregon Improvement Company.

The Kaslo & Slocan Railroad Company are having 15 freight cars built by the St. Charles Car Company.

The Wabash Railroad Company are having 60 freight cars built by the St. Charles Car Company.

The Michigan Peninsular Car Company are constructing five cars for the Cudahy Refrigerator Company.

The Erie Railroad Company are having 500 freight cars built at Michigan Peninsular Car Works.

The Pullman Palace Car Company are building two passenger cars for the Chicago & Alton Railroad.

Thirty-two freight cars are under construction at the St. Charles Car Works for the International Railway.

The Missouri Car and Foundry Com-

(Continued on page 711.)

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

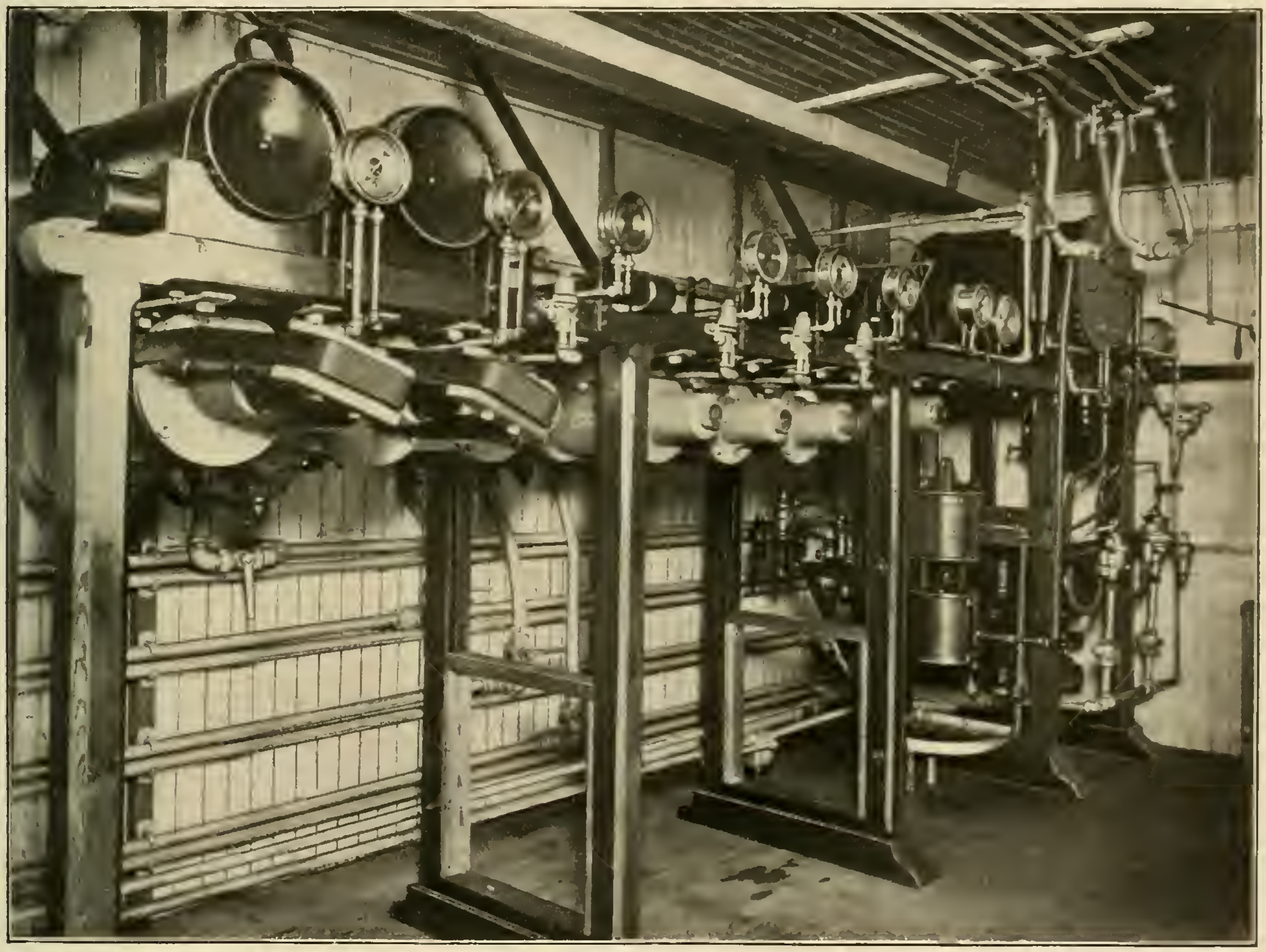
Air-Brake Instruction Room, Delaware, Lackawanna & Western Railroad, Syracuse, N. Y.

Editors:

The accompanying photograph illustrates the air-brake instruction room and test plant recently designed and built by Lewis Kistler, master mechanic of the Delaware, Lackawanna & Western Railroad, at Syracuse, N. Y., for the benefit of the employés who wish to improve their knowledge of air brakes and air-brake practice. The room is painted a light drab color. It is heated in winter by steam, and is lighted with gas. A desk, thirty chairs, a 4 x 7-foot blackboard and several pictures showing cuts of the several parts of the air-brake equipment, constitute the principal furniture of the room, and are not shown in the photograph.

One part of this room (not shown in the photograph) is set apart for air-brake repairs, and here the larger part of the repair work is done. The corner is fitted with a work bench 4½ x 2½ feet, a small vise and cupboards for stock and repair parts. The corner is also supplied with a steam and air gage testing pump.

The rack is made of Georgia pine, finished in natural wood. It is 16½ feet long, 3 feet wide, 6 feet high, and contains a complete air-brake outfit for an engine, tender, four freight cars and two passenger coaches, with piping and hose complete.



AIR-BRAKE INSTRUCTION ROOM, D., L. & W. R. R., SYRACUSE, N. Y.

The engine equipment consists of a main reservoir of 15,000 cubic inches capacity, 50 feet of 1-inch train-line pipe, 40 feet of ¾-inch signal line pipe, one F-6 and one D-8 brake valve, one 8-inch and one 9½-inch air pump, one pump governor, one car drain cup, one duplex operating air gage, one steam gage, and one duplex air gage connected to the auxiliary reservoir and brake cylinder of the dirver brake. There is also a large gage on the signal line, and a duplex gage on each auxiliary reservoir and brake cylinder.

The sectional parts consist of an 8-inch pump, showing the main piston, reversing cylinder, reversing valve cap and main steam valve bush in section, an F-6 brake valve showing all the parts and passage-ways; sectional pump governor, retaining valves, hose couplings, and all the smaller air-brake parts. A sectional F-27 triple valve is suspended on a small iron crane, and can be swung out in the room for easy and clear inspection.

The men take great interest in the little plant, and appreciate Master Mechanic Kistler's kindness and progressiveness in setting apart this room and fitting it up for their use.

Regular meetings are held, and are well attended. The men have organized what is known as the "Lackawanna Air-Brake Club," of which F. G. Townsend is president; C. A. Woodcock, vice-president, and J. F. Callahan, secretary and treasurer.

THE LACKAWANNA AIR-BRAKE CLUB,
D. L. & W. R. R.

Syracuse, N. Y.

[Having been a chance visitor to a

meeting of this club one evening, and having seen the high order of the proceedings, we take pleasure in saying that the fruit borne from this little plant must be immensely pleasing to Master Mechanic Kistler. The students in this club are, as a class, abreast of the best, and second to none in air-brake knowledge.—Ed.]

Inside vs. Outside Hung Brakes, and the Tilting Effect on Trucks.

Editors:

The accompanying diagrams illustrate two methods of suspending brake beams on four-wheel passenger car trucks, as well as the tilting effect on the trucks during the application of the brake.

Figure No. 1 shows a four-wheel truck with seven-foot wheel-base and with outside suspended beams, and Figure No. 2 shows the same truck, but with inside suspended beams.

The horizontal arrows show the direction in which the car is running, the circular arrows show the direction in which the wheels rotate, and the vertical arrows indicate the direction of the forces which tend to tilt the truck frames.

Considering first trucks with outside hung beams, Figure 1 shows that the rotation of the wheels tends to force the rear beam upwards and the front beam downwards, and that lever arms have a length of $l + l^1 = L$ for the front end, and $l^2 + l^3 = L$ for the rear end, or, in other words, from the centers of the hangers to the center of the truck, a length equal to about 5 feet 3 inches for each arm.

Assuming a passenger coach with weight of 50,000 pounds and 90 per cent. brake power, we have a force on each beam of 11,250 pounds, and with a coefficient of friction of .30 the force tending to move the beams is 3,375 pounds. Assuming again that this force is transferred as a whole to the brake hangers the total moment will be $3{,}375 \times 5' \ 3'' \times 2 = 35{,}437$ foot pounds; add to this the forward momentum of the car body, truck bolster and frame, and the effect will be as shown in Figure 1, i. e., the truck frame is tilted forward until it is arrested by the bolster, and if the application is quite severe, even the bolster may be tilted.

That the conditions actually take place may be seen by watching any passenger train equipped with outside beams, immediately before it comes to a stop after a severe application of the brake. It will also be noticed by a close observer that as the train stops there is a recoil of the truck frame caused by the action of the springs, which strive to bring the trucks back to the horizontal position, and this recoil is what causes the unpleasant sensation so often felt by those riding in the cars. Comparing Figure 1 with Figure 2 it is seen at once that the lever arms are very much shorter, and that the tilting tendency is in the opposite direction or backwards.

Considering, however, the lever arms L as about 1 foot 7 inches long and using the same force as before, viz., 3,375 pounds, the moment is only $3{,}375 \times 1' \ 7'' \times 2 = 10{,}687$ foot pounds, or nearly three and one-half times less than with outside beams. Besides the reduction due to the lever arm, the forward momentum of car body, truck bolster and truck frame tend to counteract the backward tilting tendency, and the result is practically as shown in Figure 2, the unpleasant recoil is nearly absent and the riding of the cars considerably improved.

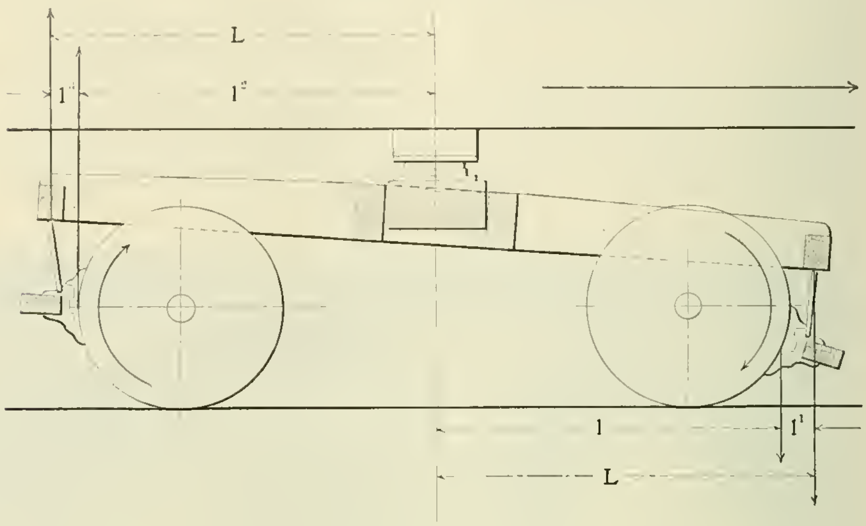


Fig. 1

TRUCK TILTING ON OUTSIDE HUNG BRAKE.

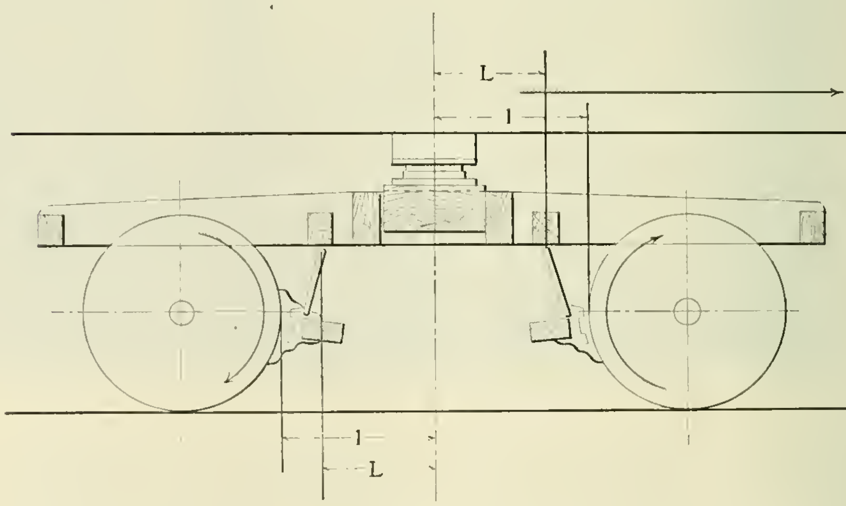


Fig. 2

NO CONSIDERABLE TILTING ON INSIDE HUNG BRAKE.

C. L.

Altoona, Pa.

Handy Tools for Triple-Valve Work.

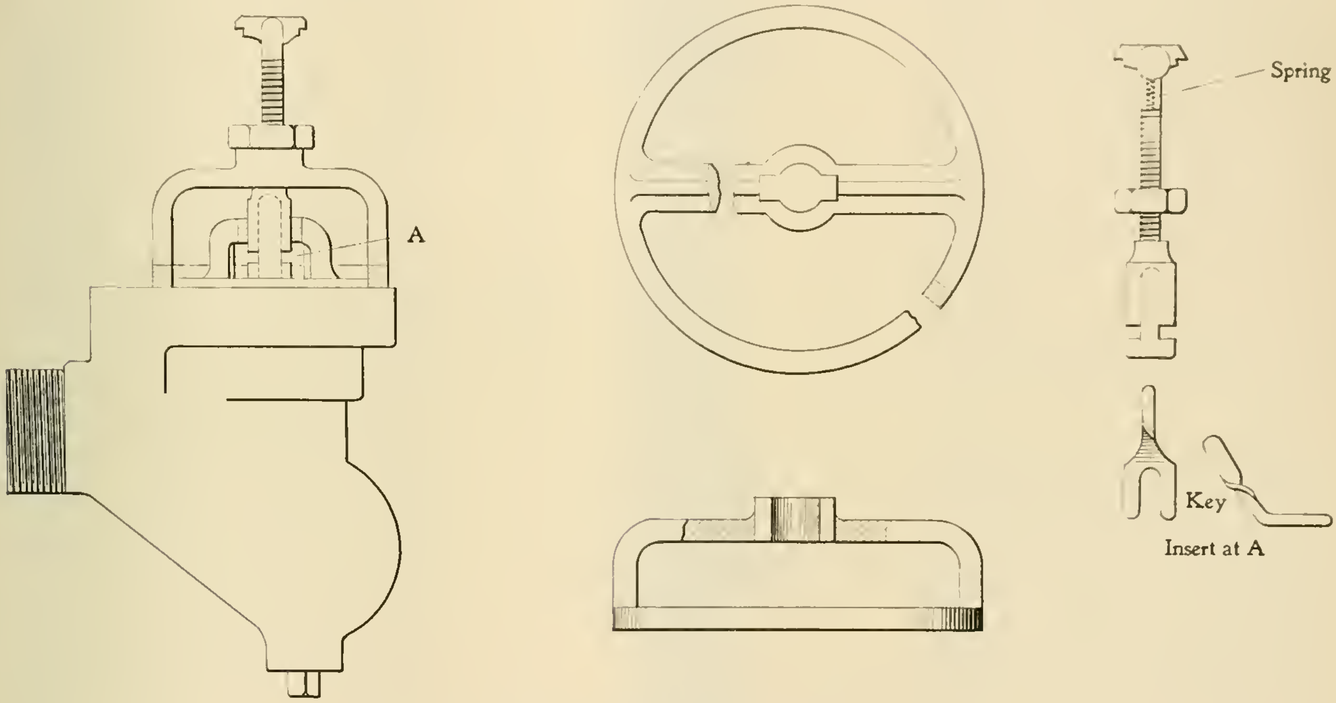
Editors:

The recent articles in "Locomotive Engineering" respecting the importance of the proper care of the check valve of the Westinghouse quick-action triple-valve, induces the writer to mention the awkward manner in which many repair men proceed to grind the check valve to its seat. It is not uncommon to see operators using a stick forced into the opening of the valve, twirling it to grind in the valve. The check valve should be properly ground, if the 20 per cent. additional pressure in the brake cylinder shall accomplish its intent.

The sketches herewith submitted show a simple device and quick method for grinding the valve. The brace is made from an old reversing valve stem, with proper offset. The end is cut off and flattened as shown, leaving the ears as a guide for the plug. The plug is made of brass and sawed to allow tension to obtain a snug fit when it is forced into the valve.

Attach to the tool box a suitable bracket to hold the check valve case, and grind the valve to its seat with oil and a medium grade of pulverized quartz or ground glass, occasionally raising the valve from its seat and reversing the stroke, to guard against producing grooves. With a piece of waste, use the brace to clean the check valve case and emergency piston bush.

A sketch of a jack is also shown for drawing the emergency valve seat from the check valve case and triple valve body. To operate the jack, invert the frame and use the adjustable steel head to withdraw the seat from the body of the triple. The emergency valve seat is a hard customer to remove at times, and the practice of pounding it should not be resorted to, as damage will surely be the result.



JACK FOR REMOVING EMERGENCY VALVE SEAT.

As shown, the device is a "sure go." There is no patent on it. It is manufactured and sold by J. S. Crane, Lakeport, N. H., for $1. It will last a lifetime, save dollars in gaskets and lots of annoyance.

Wm. H. Durant.

Concord, N. H.

Position of Brake Valve While Backing Passenger Trains.

Editors:

I notice in May issue question No. 77 by T. E. M., asking which would be the proper position for engineer's brake valve handle, while backing the train. The answer to question No. 77 advises the valve to be placed on lap. In June number I see this article appears again, and it seems there is some difference in the idea of the proper position of the brake valve while train is being backed, and which nearly every passenger train has to contend with. We have to back our trains to the depot, the distance being nearly three miles. I would like to hear the opinions of some of the readers of "Locomotive Engineering" on this subject, and have a ruling, as we all have occasion to use this every day.

H. Muir,
Engineer Southern Railway.

Georgetown, Ky.

Regarding the Equalizing Piston.

Editors:

In passing through the shops the other day, I came to an engineer who was cleaning his brake valve. I noticed that the portion of piston 47 which extends below the seat, into the train pipe exhaust, was cut off, or had never been placed on this piston. I made some remark about it, and he said that it did not make any difference whether that projection was on or not. I told him that my impression was that this part of piston 47 was to act in a manner as a choke to make a more gradual reduction in the train pipe pressure. If this part of the piston were cut off, would it not have a tendency to throw triples on a very short train into quick action?

We frequently in our work have just one car of air, which, with very few exceptions, goes into quick action when the service position is used. In taking on two or three more air cars this trouble will disappear. Now, I understand that this could be caused by the triple valve or brake valve not being in proper condition, but if either of those were the cause, I think it would occur with two or three cars almost as readily as with one. The point I want to be sure of is this: Does not the shortness of train pipe cut a figure in this case?

Wm. Holbrook,
Engr. P., C. C. & St. L. Ry.

Dennison, O.

[It cuts an important figure. In equalizing brake valves of earlier manufacture the equalizing piston was made without this teat, and on very short air braked trains, say one car trains, quick action would frequently occur when the service position was used. It was discovered that the piston in suddenly lifting from its seat would present a sufficiently large discharge opening to cause an impulse to be given to the column of air in the train pipe that would start quick action. The teat was introduced to remedy this trouble, and subsequently was made cone shaped to render it more effectual. On some roads this teat has been added by drilling and tapping the end of the piston stem to receive it, and is considered good practice. The piston coming under your observation is probably one of the earlier type.—Ed.]

Argument Against Having a Standard Brake.

Editors:

In commenting on correspondence on standards, page 450, June number, you say that I "seem to forget or lose sight of the fact that the adoption of standard forms of brakes and couplers was brought about by practical men who were well qualified to legislate on these questions."

I have not lost sight of any of the facts, and regard them as able men who believe their policy the best, but I also believe there are just as able and capable men outside of those associations, whose opinions may be as good as theirs.

The M. C. B. standard for brakes was made almost entirely from tests between the American brake system and the Westinghouse system, and they were conducted on a scale that entirely excluded individuals who were without the necessary pecuniary means. I do not think there were any corresponding tests that "relegated wooden springs on trucks and established the superiority of the link for locomotives;" it was a question of the survival of the fittest, and they survived without any standard legislation in their favor.

On page 451 is an article by Amos Judd, which says "Mr. Smith regards with disfavor all standards, and implies that it would be advantageous to railway companies to not adopt any standards. This," he says, "would be advantageous to every Tom, Dick or Harry who had an air brake to sell, but the railways would suffer. The patient would be dead long before it had taken all the doses prescribed for it by the numerous medicine men." Well, this patient lived and thrived for many years, and was vigorous and appeared to enjoy good health before Doctor Standard hung out his shingle, but has been in a kind of collapsed state ever since. In many cases it is all Doctor Receiver can do to keep life in the patient.

Certainly it does not follow that because the door is opened to improvements that railways would be bound to take all the doses that might be offered. He further says: "The locomotive builders who opposed the link for locomotive service were on the wrong side, as it has since transpired." Very well, Doctor Standard didn't have his diploma then to prevent that fact from transpiring. Suppose he would take in his shingle for a while, it might turn out that some of his standard pills were very costly.

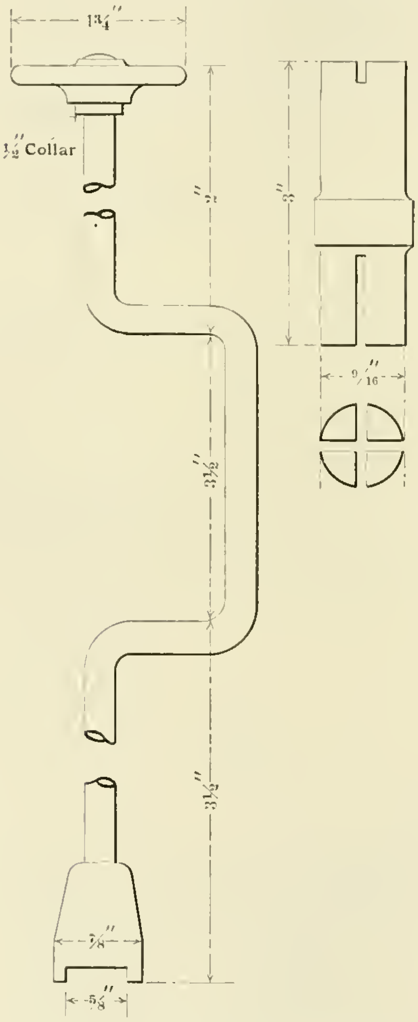
Benj. W. Smith.

Princeton, Ind.

[Our correspondent is in error regarding the competing brakes in the M. C. B. Burlington trials. There were several others. We will say more about this test in our next number.

The scale on which the tests were conducted was necessarily costly. The railways have a right to demand that air brakes shall do certain high grade work, and that the cost of developing such systems shall be borne by the manufacturer. Fifty-car freight trains were getting common, and as it was only a matter of time when all cars would be braked, it was but a wise and sensible precaution to require an acceptable brake to be one that would operate on all cars in a 50-car train; and the only way to find this out was to try it. If a locomotive were guaranteed to haul 50 cars over a certain grade, what road would be content to see her haul 10 cars, and take the builder's word that she would haul 50?

The course taken by the railways proved to be a wise one, as results show. The success of the present form of brake was a "survival of the fittest," without any assistance from our correspondent's mythical "Doctor Standard," the alleged compounder of the deadly "Standard Pills." Nor did this close the door to improvement. It is as wide open as ever. The M. C. B. Association never adopted a standard brake or standard coupler.



BRACE MADE FROM OLD REVERSING ROD.

They only required them to do certain high grade work.

By the way, who is this mysterious personage who squats in our midst, hangs out his doctor's shingle, and proceeds to compound knock-out pills which he forces down the throats of defenseless railroads? Who is this, whose presence places a blight on vigorous, healthy railroads, and forces them into "Doctor Receiver's" hospital? Whence this awful power? Why is his obnoxious existence tolerated? We can recognize no substantial being conforming to this description. His existence and power are imaginary.

We do know a "Doctor Standard," however, a different sort of fellow. A railway physician, by the way, made wise by experience, and about whom we will write quite fully in our next number. —Ed.]

Backing-Up Passenger Trains.

Editors:

In regard to the use of "back-up hose," would say, I have been very much interested in the writings of E. H. De Groot, Jr., as I consider such matter of very much value to air-brake men in general, and I would like to say a few words on the subject. I introduced the use of back-up hose on the road which I am connected with about seven years ago, and this last winter they came into general use at all the points where trains are backed.

Before deciding in what position the handle of the engineer's valve should be carried, I gave the matter careful consideration and made some tests, and concluded it should be carried in running position. My reasons for so deciding were, first, it is the position which we teach engineers to carry the handle when not using the brake, and I thought if we were now to say to them that, when backing a train, you must carry the handle on lap, and if the brake is applied and train stopped to move it to full release and then back on lap, and let it remain there until the train is again stopped, it would tend to get a man into a dangerous habit, as the handle might be moved back on to lap after making a stop, or slow down on the road and then run for miles without noticing it, other things taking their attention, and engineers have a great many things to take their attention, especially when approaching a large terminal where a slow-down is generally made.

My second reason is covered in Mr. De Groot's articles on this subject, as we have places where trains are backed four or five miles at times. Also if the handle is brought back on lap, the auxiliary reservoirs in a good many cases would not get recharged.

My third reason was, on account of obtaining a more satisfactory release than when it is necessary for the engineer to move the handle, as is the case if it is carried on lap. For instance, a train approaches a point where it is desired to slow down, with the handle on lap the brake would remain set and the train be brought to a stop; but when in running position, very soon after the back-up hose valve is closed, the brakes will release, preventing a stop when not desired.

My fourth reason was, the preventing of the accumulation of too high a main-reservoir pressure, as would be the case if handle was carried on lap, unless pump throttle was closed, or nearly so, and this I consider dangerous practice, as there is a chance of its being forgotten.

The above, of course, would not be true with the improved Westinghouse valve; but at the time we began to use back-up hose we had only the D-8 valve in use.

I do not want the reader to think that, when arriving at the conclusion that the handle should be carried in running position, instead of on lap, I had lost sight of the fact that when the brake is applied with handle in running position, that there is a waste of air by the main-reservoir pressure escaping through the train line to the atmosphere, for I did not, and made tests to find how this would affect the main-reservoir pressure, and found that for the short time that the back-up hose valve was open, it did not materially affect it, and I thought it was better and safer to waste a little air in this way than to teach the carrying of the handle on lap.

E. E. DESOE,
A. B. & S. H. Inspector,
B. & A. R. R.

Springfield, Mass.

[The original question regarding the proper position for carrying the brake valve handle when backing passenger trains into stations was asked in Question 77, May number, by "F. E. M.," who presumably runs into the Union Station, St. Louis, Mo., into which trains are backed for a distance of a quarter of a mile or so. For his use, and for the use of others in similar places, we prescribed the practice of carrying the handle on lap position, with a view of placing the responsibility of the train being safely braked into the station on the man at the back-up hose, and relieving the engineer from any responsibility which it might be deemed desirable to involve in event of the train or bumping post being damaged, through the carelessness of the operator of the back-up hose. We did not intend to advise the handle being carried on lap where trains are backed up for three or four miles, and that no main-reservoir pressure be admitted to the train pipe during that time.—Ed.]

Tool for Extracting Valve Chamber Bush.

Editors:

I submit herewith a device for removing the upper valve chamber bush of an eight-inch air pump. It is simple and consists of but three pieces, a screw and two threaded pieces with flanges on the bottom. I do not know the inventor.

The two sections with thread and flange are held together and dropped into bush to the bottom of chamber, the point of screw is then inserted and turned with the hand till the point bearing on the bottom of chamber will cause the flanged pieces to rise and engage the bottom of bush, which by means of a wrench can be forced upward no matter how tight. If the flange pieces do not drop together, a touch with the finger will set them right, as they cannot pass each other on the wrong side.

C. R. ORD,
Air Brake Insp'r., Can. Pac. Ry.

Toronto, Can.

Take Better Care of the Air Pump.

Editors:

Having had considerable experience with the air pump, I would like to ask some of my brother locomotive engineers a few questions.

When you are starting the train, do you pull the throttle wide open on the instant, and with the reverse lever in the corner for a mile or two, let the engine slip and pound and tear things to pieces generally?

BUSH EXTRACTOR FOR AIR PUMPS.

No, you do not. You say the engine would soon be in the shop for repairs. The valves and packing would soon blow. It would be difficult to keep lubricated, and bad pounds would soon develop in brasses and boxes.

But how about the air pump? You have probably given it this sort of treatment, have you not? Is it strange you are always complaining that your air pump gives you so much trouble? It pounds; gets hot; the valves stick or get broken. The piston will not keep packed but a trip or two. The pump stops; you have to keep tapping the top head occasionally to start it; then it becomes dry. You just blame it on the bad quality of oil, and consequently increase the feed of the lubricator.

Now, suppose you treat a pump as you would the engine. Open the throttle on the boiler that supplies the pump with steam, about one-quarter turn for a train of two or three cars, one-half turn for four or five cars, and three-quarters of a turn for any greater number of cars. "This will not supply enough air," you say. If the pump is in good order to begin with, you will have no trouble. It will supply all the air pressure necessary, if you handle the brake valve as you should. The pump will keep in good condition. It will be impossible for it to run fast enough to do any damage. You will have little trouble keeping it nicely packed, and you will be surprised how well the lubricator keeps it oiled. The pump will seldom stop while on the road, and you will wonder why you did not throttle it down long ago.

The Westinghouse people formerly instructed to run the pump at a good speed, but subsequently they modified their instruction, I believe, and said to run it moderately. My personal experience, covering a number of years in passenger service, is to run the pump just as slow as will do the work properly.

J. J. CLAIR.

Pittsburg, Pa.

Equalizing Piston Sticking.

Editors:

In answer to your criticism of my article in August number, I would state that I agree with your opinions exactly, providing everything is in perfect working order. But you must know that on a large system it is next to impossible to have everything in perfect working order, and consequently even what seems to be impossible may sometimes happen, as was the case of two brake valves I referred to. They had been working to all appearances perfectly, but the equalizing piston stuck, and after being taken apart and examined it was found to be clean and apparently in first-class condition.

The road on which this trouble occurred, in size is second to none, and the brakes are kept up to as near standard as it is possible, and is known to be the best equipped road in the country.

With regard to the quick action feature, I would like to say that with unequal travel and leaky cylinders, etc., you might get the pressure a full service stop should give, but it will not be equal throughout train, and therefore proves the absolute necessity of a slack adjuster, if the test is to be up to the standard. Equalized pressure is a very essential point, as it overcomes slid flat wheels and sundry other troubles.

EARNEST ARMSTRONG.

Camden, N. J.

A Bad Habit.

Editors:

A habit of many, and one that is not fully appreciated, consists in making too heavy a train-line reduction. Although this applies to both passenger and freight service, the bad results are more noticeable on freight, on account of the braking power being less on freight cars and the fact that many trains, partially air equipped, furnish the retarding force to the train.

With a train in proper condition, a twenty-pound reduction should give full service braking power. Where the train has been running on a level for some distance with brakes set, it is permissible to make a twenty-five-pound reduction, as the extra five-pound reduction makes up for the natural leakage through the pores of the packing leathers in the brake cylinders. A further reduction is not only a waste of train-line pressure which will be missed in releasing brakes, but there is also a loss in braking power.

We all know that there are no tight packing rings. If we reduce train-line pressure, say to thirty-five pounds, we have the train line fifteen pounds below the ordinary equalization point of the auxiliary reservoir and brake-cylinder pressures. The triple piston has moved to emergency position, and we have a direct communication between the auxiliary reservoir and brake cylinder. Both of these pressures are leaking by the triple piston packing ring into the train line, until equalized with the train line. If the packing ring in piston 47 of the engineer's valve is in good condition, the train-line pressure, being increased by the flow of air from the auxiliaries and cylinders, forces the piston from its seat, and the lost braking power goes out at the train-line exhaust. If the emergency check leaks, as it sometimes does, another way is open for brake cylinder pressure to leak into the train line when too heavy a reduction is made.

These things go to show that after a full reduction has been made, the use of sand is all that is left to aid us, and its use at this particular time is liable to cause large flat spots, if any wheels happen to be skidding. If the train does not then slow down, a call for brakes is in order, or it will be another case of so-called failure of brakes.

We know packing rings do leak; for, with the engineer's valve on lap and the gaskets in good condition, how would the black hand show a leak on the train line, were it not for the little drum pressure leaking into the train line by the packing ring of piston 47?

Occasionally the question is asked. Why is it that with a five, ten, fifteen or twenty pound reduction I get the regular train-line exhaust and my piston seats and is tight; but if I make a heavier reduction than twenty pounds I get the regular train-line exhaust, and then continue to get a light blow, the length of which depends upon the number of cars in the train? It is for no other reasons than the ones stated above. The train-line pressure being below the equalization point of the auxiliaries and brake cylinders, these pressures are feeding by the triple piston packing ring and by the train-line check, in case it leaks, into the train line, forcing the equalizing piston in the engineer's valve from its seat. This will not happen on all cars, as occasionally the triple pistons form a joint on the leather gasket, so that the air cannot get by into the train line. This gasket is usually rather hard, however, and there is not much likelihood for an air-tight joint.

If any want to get an idea of how fast air leaks by a packing ring, cut out the plain triple on the tank or engine after charging up, remove the graduating nut and put your hand over the hole, and note the escape of pressure. Another way to see the same thing is to put the engineer's valve on lap, after charging up, and open the angle cock on the tank. Watch and see how long it takes the black hand to go to zero, and you will see how long it takes for all the little drum pressure to leak by the packing ring of piston 47.

R. H. Blackall,
D. & H. C. Co.

Oneonta, N. Y.

An Experience with a Releasing Driver Brake.

Editors:

In question 92, air brake subjects, H. T., Paducah, Ky., says the brakes stay set until a point of equalization and then whistle off, and he wants to know what the trouble is. The answer blames the check valves, and in his case may be the cause.

I am using an E-6 brake valve, and hardly ever reduce train line below fifteen pounds. Lately, however, not having air cars enough to hold train without the hand brake, I have reduced train line twenty-five pounds, and driver brake whistled off, presumably caused by a leaky check valve. After getting on a sidetrack I closed the angle cock on the engine, reduced twenty-five pounds and driver brake whistled off.

Engine having plain triples it could not be check valves. I made up my mind it was a leaky triple piston packing ring. I took down the triples and the packing ring seemed stuck. I cleaned it in good shape, and oiled it. Put it up and it worked O. K. It would not whistle off no matter what reduction was made. The black hand did not rise as it did before.

Now, could the slide valve spring be so weak that the greater area on the under side of the piston with the same air pressure move the triple to release position? Question 46, March, 1897, could not a leaky graduating valve be the cause of the trouble described in question 46?

L. W. Tighe.

Nashua, N. H.

[A leaky graduating valve, unless aided by a leaky slide valve, or its seat, cannot cause the triple to go to release position. It can start it there, however, but if the slide valve and its seat are tight, it will stop as soon as the port in the face of the slide valve ceases to register with the brake cylinder port in the seat. The port in the face of the slide valve is now blanked, and air passing through a leaky graduating valve will find no outlet unless the ground surface between the slide valve seat and its face is imperfect, then the triple would be equally liable to whistle off after making a five, ten, fifteen or eighteen pound reduction, or any other reduction, until the brake was fully applied, when the trouble would almost entirely disappear. The answer prescribed to question 92 fits the case according to the conditions given, which are contrary to those caused by a leaky graduating and slide valve, and to which the latter could not be fitted.

The cause of the trouble in your case was probably a combination of corroded piston packing ring, which permitted auxiliary reservoir pressure to pass into the train pipe, and dirt under the slide valve, and perhaps under the graduating valve also, which caused a reduction in auxiliary reservoir pressure sufficient to cause the triple to go to release position. The dirt was probably removed when the packing ring was loosened up.

The area of the triple piston is equal on both sides unless it is at full application position resting on the leather gasket.

The slide valve spring cuts little or no figure in this case.—Ed.]

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(101) J. L. W., Richmond, Va., asks:

Why is it that after making a 20-pound reduction and releasing, on some trains, the main reservoir pressure will drop down below 70 pounds, while on others it will not come down to 70? A.—This is due to the difference in the length of the train, the increased volume of the long train pipe taking more of the main reservoir pressure than the short one.

(102) D. T. J., Scranton, Pa., asks:

Why is it that, after making a 20 or 25 pound reduction in train-pipe pressure, a further reduction sometimes holds better? A.—Sometimes defective packing leathers will allow a portion of the brake cylinder pressure to escape, and then a further reduction will hold better. At other times it is imagination, and is caused by the reduction in the speed of the train, the brakes holding better as the speed decreases.

(103) A. L. O., Louisville, Ky., asks:

Is there any difference in the size of the preliminary exhaust ports in the D-8 and F-6 engineers' brake valve? If so, why is the difference made? A.—The preliminary exhaust port in the D-8 brake valve is 3-32 inch, and in the F-6, 5-64 inch—the difference in size being made necessary by reason of the greater freedom with which the air can escape from the Plate F-6, as compared with the Plate D-8; in the latter the preliminary discharge occurring in a small cavity that, in a measure, restricts the free discharge of the air. In case of both brake valves, the same quantity of air can be discharged, as nearly as may be, in a given time.

(104) J. E. R., Tamaqua, Pa., writes:

Suppose a car is placed on siding with air brake applied, and is to be moved shortly afterward by an engine having no air pump. The trainman finds release valve blocked so it cannot be used. Can said brake be released without the use of a wrench? A friend of mine says that it can by opening angle cock and closing quickly, which will surge the air in train pipe and cause release to take place at triple. I say it cannot be done, as that would set brake harder. Please let me know through your paper who is right. A.—You are right. The "surge," as it is commonly known, only occurs on trains of some considerable length, and cannot be made on one car.

(105) J. R. K., Kansas City, Mo., writes:

Please decide the following argument: Suppose we take an auxiliary reservoir, charge it to 70 pounds pressure, then make a reduction of 10 pounds in the train pipe, and note the resulting pressure in the brake cylinder. Release the brake. Now charge auxiliary and train pipe to 50 pounds. Then reduce train pipe 10 pounds, and note resulting pressure in brake cylinder. Will the 10-pound reduction in both cases give the same pressure in the brake cylinder? A says it will, and B says it will not. A.—A is right. An auxiliary reservoir charged to 50 pounds will give practically the same brake cylinder pressure, on a 10-pound reduction, as one charged to 70 pounds, the piston travel being the same in both cases. However, on a 20-pound reduction, or when the brakes are fully applied, the 70-pound brake will give about 50, and the 50-pound brake about 35 pounds in the cylinder.

(106) H. L. M., Providence, R. I., writes:

There has been a great deal of controversy about how an emergency application should be made. Please say whether the brake valve handle should remain in the emergency position after making an emergency application, or whether it should be returned to lap, and thereby save air. Also say what the general practice is on the various roads. A.—The brake valve handle should be left in the emergency position, making the application sure and the stop as quickly as possible. In close quarters and during perilous moments, saving of air is of little importance compared to saving one's hide. An engineer has no time or inclination, during his exciting period, to fumble around for the lap position and calculate how much air may be saved. He will employ his time and thoughts more profitably in selecting a short route and executing a speedy exit from the cab to a soft spot on the ground.

(107) J. C., Chicago, Ill., writes:

We are told that with a broken graduating valve pin in the quick action triple valve that with a light reduction this brake will be the last to go on, and when it does go on it will go on with the emergency application and cause the rest of the train to go on with the full service application. Now, with a train of fifteen passenger coaches we know there is more volume than there is in a train of five coaches. Say, the engineer discharges ten pounds of steam at his brake valve, will the volume of air which is necessary to reduce the train line the other ten pounds before a full service application is obtained on the rest of the train all go into the one brake cylinder on the fifteen car train just the same as it would on a five car train? A.—The triple with broken graduating valve pin would apply in emergency when the combined resistance of the reduced train pipe pressure, tension of the graduating spring and friction of the slide valve and piston packing ring would allow the auxiliary reservoir pressure to force the triple in position to operate the quick action parts. This will vary according to the condition of the triple, and may require a reduction anywhere between eight and fifteen pounds. If it sets with eight or ten pounds reduction, all the other triples, although having partially applied brakes in service position application, will each open their quick action ports and take in a portion of the train line pressure. This would be a partial service and partial emergency application, and would be the same on all cars regardless of whether it was a five or fifteen car train. However, should the defective triple not apply until after a fourteen or fifteen pound reduction had been made, it would only take in a certain amount of train pipe pressure and refuse the rest. The pressure in the auxiliaries and train pipe of the other cars would be so near equalization that it would be doubtful if their triples could take in any train pipe pressure; but they would apply tighter in service application. This would also be the same on a five or fifteen car train. A further reduction of train pipe pressure at the brake valve would probably slightly increase the brake cylinder pressure on all cars but the one with the defective triple.

Mr. Fred Ham, general air brake inspector of the W. N. Y. & P. Ry., at Buffalo, N. Y., writes us that he is getting very satisfactory results from using as large a main reservoir as possible. He reports the wear on pumps in same kind of service much greater on engines having small main reservoirs.

A short while back the Plant System observed that some of their air pumps had to run at an excessively high speed to regain the pressure by the required time. As they could not very well substitute a 9½-inch pump at that time, they doubled the main reservoir capacity by putting on an additional reservoir of the same size as the one then in use. The pumps are now run at a very moderate speed. Stuck pumps, hot pumps, and lack of pressure are now things of the past.

An Odd Machine.

The Taylor hydraulic air compressor is a curious machine recently invented. It is substantially a simple pipe placed in an upright position. Water is admitted at the top end and falls the length of the pipe. A number of small tubes extend into the mouth of the pipe. One end of each tube is above the entering water, and the other end is below. The water in passing the lower end of the small tubes creates a partial vacuum, and atmospheric pressure drives innumerable small bubbles into the falling water at the mouth of the pipe. These bubbles are compressed in their downward course, and at the foot of the pipe are separated from the water by striking a cone-shaped base, the air pressure going to a receiver and the water passing off. A plant is in actual operation. The compressing pipe is about 100 feet long, and gives a surprisingly large volume of air at a pressure of 50 pounds.

A Generous Railway Company.

The recent liberal action of the Great Western Railway (England) in providing for the families of those who were killed in Coldrennick Viaduct, in Cornwall, is being universally commended by railroad men generally. In the case of widows, they advanced a month's wages, and agree to pay them for three years, in addition to the funeral expenses. This sort of treatment is sure to make men loyal to any company, and is pretty sure to be a good investment in the end.

In an article which appeared in the August number of the "London Railway Magazine," on "Racing Runs and Trial Trips," a great deal of credit is given to the Gould couplers and vestibules for enhancing the comfort of express train riding in Great Britain.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Great Northern Vestibuled Coast Train.

The Great Northern Railway is running a solid train of eight vestibuled cars between St. Paul and the coast (Seattle, Wash.) that, while laying no special claim to magnificence or georgeous appointments, attracts as much attention, by reason of its business-like appearance, as any of the bespangled and much-heralded caravans making a bid for transcontinental business with glitter for a strong card.

Notwithstanding the lack of external frills, there is no limit to the provisions made for solid comfort, as the half-tones of the interior of the buffet car plainly show. Both of these views are taken from the center of the smoking-room in each direction; one of them toward the library and kitchen, with its glass doors, and the other taking in the card-room, beyond which is the barber shop and bath-room; both of the latter are at the farther end of the car. The table, covered with periodicals, and the writing desk explain their uses. The twelve low cane seats, upholstered in yellow plush, are in perfect harmony with the interior finish of the train, which is oak, varnished—no imitation by the grainer's art—just simply oak, and an ideal place to while away the daylight hours consumed in covering the 2,000 miles between the terminals of this road.

Up to all requirements is the dining-car, with its row of wide tables on one side and narrow ones on the opposite side. The cane chairs, upholstered in leather, lend an idea of home enjoyment not felt when one is boxed in by a fixed seat, and an important advantage of the movable chair lies in the fact that one can retire from the table at his pleasure without any "entangling alliances" with the porter, which is not the case with the hinged seat, as the polite attendant is almost always too busy gathering up the largess scattered on the table by the gourmet who dines too well, but with little discretion, to lend any assistance. The chair is much the best seat, too, for comfort.

The same restful simplicity and attention to plain effects are evident in every detail, including those of the sleeping-cars, giving the impression that where money is spent it is for the sole purpose of having a useful return. In the construction of these flush vestibules, occasion was taken by Superintendent of Motive Power Pattee to strengthen the platform by introducing 6-inch steel I-beams in place of the wooden members. The two draft pieces extend through the body bolsters between the plates of same, while the platform pieces stop off at the bolster. The I-beams are tied laterally by two plates, one of which forms the carry iron.

The vestibules are further reinforced by an 8 x ⅜-inch wrought-iron plate that is let in on the posts flush with the letter-board, and extending out the full length of the vestibule. To this plate is riveted the foot of a rod that passes down to the platform at the corner post of the vestibule. In addition to this, there are diagonal iron braces at the top, which makes the vestibule as strong as any part of the car. A feature not common in vestibule construction is the end door in the vestibule of the rear car. By its use the vestibule is completely enclosed in glass, which will be found a great convenience in the snow or through sandy districts. The train, consisting of mail and express, baggage, tourist sleeper, a second class, a

GREAT NORTHERN VESTIBULED TRAIN.

first class, a dining-car, a buffet-car and one sleeper, are all painted the road's regulation terra-cotta passenger color, with enough modest striping to banish any impression of flatness. Our half-tone showing of this train is a good picture of it, taken as it was leaving St. Paul for its long, unbroken run to the coast, drawn by a 19 x 26 ten-wheeler weighing 138,000 pounds. This picture conveys a better idea of what the "wooly" West is up to in passenger transportation than words, representing, as it does, a practice that is equal to the best of its kind.

GREAT NORTHERN VESTIBULED TRAIN—BACK VIEW.

Roller Bearings on Cars.

An interesting paper on this subject was read before the English Institution of Civil Engineers by William Bayley Marshall. As a result of the experiments, the following figures are given as being perfectly reliable:

"Starting Effect.—Cars weighing 4 tons 15 cwt.; ordinary bearings, 198 pounds, or 41.68 pounds per ton; roller bearings, 30 pounds, or 6.53 pounds per ton.

"Running Friction.—Gravity test.

"A car fitted with ordinary bearings and weighing 2 tons 15 cwt. was let loose from a point 56 feet up an incline with 1 foot 6¼ inches rise. It ran down this incline and 57 feet along the level at foot of same, or a total distance of 111 feet. The force expended was therefore 6,160 pounds falling through 1.521 feet, or 9,364 foot-pounds. The average frictional resistance was 9,364 ÷ 111, or 84 pounds, equal to 30.5 pounds per ton. A similar car fitted with roller bearings being let loose from the same point, ran the full length of the level line available—namely, 320 feet—and had not then quite come to rest, the total distance traversed being 376 feet. The force expended was as above, 9,364 foot-pounds. The average frictional resistance was 9,364 ÷ 376 = 24.9 pounds, or about 9 pounds per ton of load.

"The following figures are also of interest, and are founded on the results of actual experiments in tramway practice: Relative starting effort of a tramcar on a gradient of 1 in 20—ordinary bearings, 100; roller bearings, 77; saving, 23 per cent. On a gradient of 1 in 80—ordinary bearings, 100; roller bearings, 50; saving, 50 per cent. On a gradient of 1 in 140—ordinary bearings, 100; roller bearings, 39.6; saving, 60.4 per cent.—results which require no comment."

In Blackpool the electric cars have been using roller bearings for over three years, with such satisfactory results that all new cars are fitted with them. Their consulting engineer estimates a saving a 30 per cent.; but allowing half of this for enthusiasm, and the remainder, 15 per cent., is quite an item.

The Liverpool Overhead Railway have been testing roller bearings for about two years, and are gradually equipping their cars. The City & South London Electric Railway are also experimenting in this direction, and the Waterloo & City Railway, a new line, is to be entirely equipped with them.

A passenger train of six cars has been running between Brighton and Kemp Town for two years, and a saving of 12½ to 15 per cent. in fuel is reported. The Western Railway of France is also fitting up a train for experimental purposes.

These applications show that engineers the world over are continually striving to improve the efficiency of the railway service, and all these experiments point to a source of saving. With such precedents as these, there should be little hesitancy in some of our own railroads equipping a train to determine whether or not the economy is all that is claimed for it.

A Large Gun Casting.

When the weight of castings begins to be counted by tons, they are considered "some" castings, but when they reach nearly 100 tons it makes even a mechanic open his eyes. A recent casting at the Bethlehem Iron Co., South Bethlehem, Pa., was an ingot for the largest coast defense gun ever cast. It required three furnaces to melt the metal to fill the mold, the ingot weighing 223,000 pounds. It was nearly 17 feet long and 6 feet 2 inches in diameter.

Swing Hanger Versus Rigid Trucks.

There appears to be the same old element of uncertainty clouding the question of the most advantageous position of the driver with the plain tire on a ten-wheeled engine, and also as to whether a truck should be rigid or not, in order to avoid flange and hub cutting. Discussion seems to have left the matter in its normal condition of satisfactory chaos in so far as concerns unity of action by the users of this type of power.

With a knowledge of the existing state of the situation, it is not difficult to understand some of the causes that produce it, the principal one of which is apparently a blind adherence, for or against the swing motion truck, without regard to its logical bearing in the case. It is not well established that a swing motion truck is necessary on a curvy road any more than on a straight one, if we are to be guided by the practical results unearthed by some of the most advanced motive power talent, but it is easily shown, mathematically, that when a given wheel base and a fixed amount of lateral motion between flanges and hubs, that there is a minimum radius of curve beyond which it is not safe to run a rigid truck; notwithstanding this, they are run, as is well known, and the fact that they pass curves without excessive flange wear is evidence, not so much of the superiority of the rigid truck as of an abundance of lateral play which may be due to either of two causes—one is the increased gage on the curve, and the other plenty of hub and flange freedom. When these conditions operate in conjunction, as they frequently do then is the time that we hear of the re-discovery that the rigid truck is the correct thing, and the plain tire again has its proper location assigned as a result of these conditions.

The experience of all who are brought to face the situation of cut flanges with either type of truck, is almost identical up to the experimental stage of relief. In case of disappointment with the rigid affair, they are quite likely to decide that the swing motion is a necessity, and this decision may be based on the fact that too much refinement in fitting, rather than too many degrees in the curve was the cause of the troubles that required adjustment.

The reasons adduced for the great diversity in practice, are not at all conclusive nor convincing, and from a personal acquaintance with some instances of changes in both directions, from and to the two trucks under consideration, the belief that such moves were made to satisfy prejudice, and not wholly to demonstrate a truth, became a well grounded conviction. Investigation of that kind can only bring forth fruit of the Dead Sea variety, and can have no weight in reaching conclusions on which to base a practice.

Experience has taught the rigid truck advocate that the swing hanger is not reliable in the performance of its function of pulling the end of an engine from a tangential course to curved one, and he is satisfied to seek a remedy for flange cutting, that will not involve the use of hangers. On the other hand the friends of the swing hanger, while alive to its weak points, are laboring to improve them and perfect a device that will reduce flange wear. This has been the status of the truck situation for years, and all indications point to a continuance of it until such time as those interested will understand that a swing hanger can be of no

GREAT NORTHERN BUFFET CAR.

assistance in guiding an engine on tangents, and that a rigid truck is an expensive device to run on sharp curves.

The Burlington's New Limited.

One of the finest passenger trains seen in our peregrinations is that of the "Burlington," running between Chicago, St. Paul and Minneapolis. It is a train of six of the handsomest passenger cars ever placed in commission, having electricity, together with steam heat and all appointments that lap away over the border of ordinary luxury in travel, and the first and lasting impression is that the limit of the purchasing power of the dollar is pretty nearly approached in the way of gorgeous decorations.

The train is made up of a combined baggage, buffet and smoking car, a chair car, compartment cars, standard sleeping cars and the dining car. The buffet car has reading room with a book case well stocked with choicest literature; the buffet feature—well it furnishes ocular proof that it can satisfy almost any yearning for either solid or liquid comfort. The interior finish of the train is in mahogany, and the exterior is the standard Pullman color. About the only thing we saw that was open to criticism was the too luxurious air, apparent in everything about the train, but any feeling of uneasiness is dispelled on acquaintance with the important fact that the price of transportation remains at the old figure.

Case-Hardened Axle Journals.

The method of case-hardening and finishing axle journals has been brought as near to perfection as possible at the Great Western Railroad Works at Swindon, where all axles are treated in the following manner: The axles are first turned and polished, and then each end is separately hardened in a specially constructed furnace. The end of the axle is enclosed in a loose sheet-iron cap, the space between the axle-end and the casing is filled with "scintilla" case-hardening composition, and closed with fireclay. The end of the axle thus enclosed is put horizontally into a furnace fired with coal, and into which is injected a steam jet. About eight hours in the furnace gives a skin about 1-16 inch thick. The axle is then taken out and placed in a vertical position to cool. The case-hardening extends about an inch on to the wheel-seat. When both ends of the axle are treated, it is taken to a lathe and ground true. The wheels are then pressed on with a pressure of 60 to 70 tons, and the axle put back in a lathe and the journals polished to a very fine silver surface.

Axles so treated run an enormous number of miles and never run hot.—"Railway Engineer."

Within a short time the long talked-of pneumatic dispatch system between the New York and Brooklyn post offices will be an accomplished fact. The tubes for conveying postal matter from one city to the other are now being laid. The line will extend from the New York post office up Park Row and over the Brooklyn Bridge to the Brooklyn post office. The Ingersoll-Sergeant Drill Company, of New York, is furnishing the air compressors to supply pneumatic power for the purpose, and already has orders for several compressors.

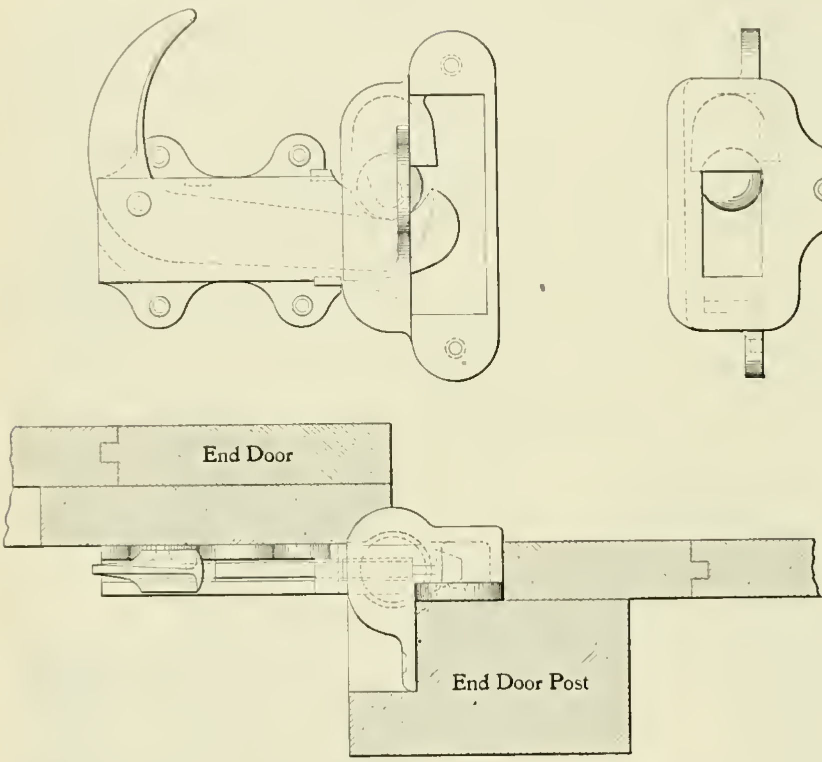
GREAT NORTHERN BUFFET CAR.

End Door Lock for Box Cars.

A lock for end doors, one that could be depended on to give security from well directed outside effort looking to designs on the contents of a box car, has long been one of the little things that seemed very easy of attainment, but somehow has had some weakness, either that due to lack of efficiency as a lock, or that of excessive cost, or both. The difficulties encountered have had the effect of bringing the later developments of the kind to the desired end.

Our engraving shows a lock that has given a record in service, which entitles it to a place among the devices that have a claim to the consideration of the car man. It is made of malleable iron and on different lines than usually seen for a device of the kind, consisting of a case fastened to the outside face of end door post, and containing a small cast ball. Another case which holds a lever is secured to the inside face of the end door. To operate the lock, the ball is lifted out of its seat by means of the pivoted lever, and this it will be seen can be done from the inside of the car only; when the ball is raised the door is free to move. The locking is perfectly automatic, and is done when the door is closed, by the lever passing under the ball, which is in its locking position on the lever when the door is shut. It is impossible to get the door open from the outside without breaking the lock.

The lock is the creation of Master Car Builder Monteer, of the Kansas City, Fort Scott & Memphis Railroad, whose efforts in the field of car work are so well-known to the car building fraternity.



MONTEER'S END DOOR LOCK.

Importance of Railroad Business.

In addressing the New York Railroad Club, Hon. Chauncey M. Depew said:

"Now, gentlemen, you are all of you in this great business. You must remember, and you do remember, that there are one million voters of us out of the thirteen million voters in the United States, and that with the men immediately dependent upon the railroad service—in the supply business—there are two million voters. We are the arteries of commerce. Without us and what we do there can be none of that vast internal communication that enables this country to live, and which makes it the greatest self-supporting country in the world. We are in touch with every business in the country, and every business in the country is largely dependent upon the intelligence and ability with which we discharge our duty.

"As I look over the railroad system of the country to-day, as I come in contact with railroad men who to-day are in positions of responsibility; as I come in contact with their assistants everywhere in other departments of the railroad service, I feel that the railroad service is a survival of the fittest; and every man who fills a place where he is recognized as the captain of ten or twenty or one hundred or ten thousand men, he is a man who possesses the capacity, the intelligence, the energy that has made him what he is, and that this aggregate of intelligence and capacity and energy is carrying on this great system of transporting, is carrying it on so that the railroad business is being conducted on lines of public beneficence, and upon lines of public benefit not equalled by any other business or any other vocation in the United States."

Indications of Better Times.

We are pleased to note that some of the roads, at least, are showing signs of better times. The Pennsylvania Railroad shops at both Altoona and the Meadows (Jersey City), are working more hours than they have for months, one of the Altoona shops working overtime recently.

The Dickson Locomotive Works also report that they are quite busy, and are employing more men than ever before.

The Chicago, Burlington & Quincy Railroad and other Western roads are reported to be working full time in many of their shops, to prevent, if possible, a shortage of cars, and other points report increased activity. We hope to have more good news of a similar character, as it is what we have been looking for and expecting—partially in vain.

James Leffel & Co., Springfield, O., U. S. A., have issued a neat new Pamphlet "D," replete with numerous illustrations and descriptions of the throttling and automatic engines, with portable and stationary boilers, which they are building in a variety of sizes and styles. Copy is sent free to parties interested, on application to the company.

The "Pall Mall Magazine" for September contains a long article on American Express Locomotives by Angus Sinclair. It contains 15 half-tone illustrations. The magazine is for sale in this office. Price 25 cents.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(61) A. G. E., Waycross, Ga., writes:

Another argument on what constitutes the correct alloy for Babbitt metal is on here, and I would be pleased if you could put us right. A.—Genuine Babbitt metal by the best of our sources of information, is composed of 50 parts of tin, 5 parts of antimony, and 1 part of copper.

(62) J. J. P., Chester, Pa., asks:

Can you tell me how much more power there is on a piston head with a full throttle, than there is with a half throttle, when the reverse lever is hooked in the sixth or seventh notch, with 120 pounds steam pressure on the boiler? A.—From indicator cards we have found the power with a full throttle to be 21 per cent. greater than with half throttle, under the stated conditions.

(63) C. J. H., Milwaukee, Wis., asks:

What is the radius of the shortest curve, a ten-wheel engine with a 15½ feet rigid wheel base—main driver without flange—will go around safely? A.—The data furnished is not sufficiently complete to enable us to answer the above. If the questioner will forward to us the distance from the center of the trailing wheel to the center of the truck, and also say whether the truck has swing hangers or is rigid, we shall be glad to furnish the information asked for.

(64) E. H. K., Arcata, Cal., writes:

Please explain a rule for finding the size of cone pulleys; for instance if you have a lathe with the cone pulleys. 5, 7 and 9 inches respectively, and the size of the largest driving pulley 25 inches, how would you find the size of the other two? A.—This subject is thoroughly treated in the "American Machinist," of Oct. 29, 1896, by the graphical method, and our correspondent is referred to it as a highly satisfactory solution of the problems of cone step pulley design.

(65) G. W. T., Saco, Me., writes:

Please give me a rule for finding the temperature of steam when only the pressure is given, also one to find the pressure when temperature is given. A.—The relation between the temperature and the pressure of steam is given in the formula:

$$t = \frac{2938.16}{6.1993544 - \log p} - 371.85,$$

in which p is the pressure in pounds per square inch and t the temperature of the steam in Fahrenheit degrees. For more particulars, see Kent's Mechanical Engineer's Pocket Book, page 659.

(66) H. L. H., Lima, O., asks:

Can you tell me why an engine, which holds the rail all right with the lever in the corner, slips when hooked up? I have never seen an explanation, but know it to be the case. Puttting the lever in the corner certainly does not place any more weight on the drivers, but the engine will nearly always stop slipping when that is done. A.—Dropping the lever in the corner gives the maximum point of cut-off—about 23 inches in engines having a stroke of 24 inches. This cut-off, by allowing the steam to act on the piston nearly the full stroke, causes a more equable turning effort at the wheels than when steam is cut off at shorter points, and this equality of pressure is what is supposed to stop the slip. Partially closing the throttle is sometimes resorted to in order to effect the same result.

(67) F. O. R., Sacramento, Cal., asks:

Can you give me a reliable formula for finding the load on a side rod, due to centrifugal force? A—The equation $F = \frac{W V^2}{r\ g}$ will give the centrifugal force, where F = force, V^2 = square of the velocity in feet per second of the rod in its path, r = the radius of the rod's path in feet = radius of crank pin path, W = the weight or rod in pounds, and g = acceleration of gravity or 32.2 feet per second. The force found by the formula is in pounds, and acts as a uniformly distributed load when the rod is of symmetrical cross section, twice in each revolution. The conditions are practically those of a beam with a distributed load, supported at each end, and should be so treated in the calculations for a section to resist the stresses due to the forces considered.

(68) E. L. F., Grand Rapids, Mich., writes:

I understand that inside check valves are in use on some locomotive boilers. Will you please explain their construction and say in what respect, if any, they are superior to the outside check? A.—The inside check is generally made with a flange by which to fasten it to the outside of the boiler. Projecting inwardly from the flange, there is a neck which forms the valve seat. The valve is made to fall and seat itself by being pivoted above the seat, swinging to or from it as the pressure is greater or less. and always closing by the pressure from within the boiler when the injector ceases to work. The best thing claimed for it is that in the event of wreck and a broken check, steam is confined to the boiler and thus deprived of the opportunity to escape by that channel and get in its deadly work.

(69) F. C. P., Dayton, Ohio, asks:

1. Who invented the steam gage? A.—The name of the man who first devised a gage to measure steam pressures has

not been preserved to us. The bent tube containing mercury was probably the first form of gage used for this purpose, but as pressures increased, they were inadequate, and other forms had to be devised. The first mention of an inventor's name in this connection is that of Bourdon, a Frenchman, who invented the gage bearing his name about 1850. 2. How was the accuracy of the steam gage determined? A.—By the mercurial column and test pump, pressure from the latter causing the mercury to ascend the tube to a hight proportional to the pressure. For the above information we are indebted to the Utica Steam Gage Co., who will be glad to send their little folder on "Historical Pressure Gages" to anyone interested.

(70) E. L. C., Dublin, Ireland, writes:

I am one of your subscribers and would be greatly obliged if you would inform me how the valves are worked on the Vauclain compounds, and how many are running at the present time; also, what is the receiver, what are its functions, and where is it placed? A.—The valves are of the piston variety and actuated by an ordinary link motion; one valve being common to each pair of cylinders. There are 800 Vauclain compounds now in service. The receiver is a hollow body usually cylindrical in section, extending from the exhaust passage of the high pressure cylinder to the steam passage of the low pressure cylinder, and as its name implies, receives the steam exhausted from the high pressure cylinder, from which it passes into the low pressure cylinder when the valve of the latter opens to take steam. The receiver in American engines is placed inside the smoke box whose contour it closely follows, and has a volume of from 1 to 1½ times that of the high pressure cylinder.

(71) J. E. P., Des Moines, Ia., writes:

1. I recently saw a locomotive which was built in 1873. The boiler seemed to be of greater length and smaller diameter than the locomotive boilers of the present day, which I believe are shorter, but of larger diameter. Will you kindly explain the advantage of the boiler of the shorter length and greater diameter? A.—It is quite likely that our correspondent is mistaken as to the greater length of the old boiler, since the small diameter would cause it to appear longer, even if the length were the same or less than the large boilers of to-day. If, however, it were really longer, the advantage of the larger diameter will be apparent if the areas of two boilers are compared, taking the small one to be, say, 46 inches in diameter and the large one to be 60 inches—fair proportions for the periods under consideration. Then we have areas of 1661.9 and 2827.4 square inches, respectively, from which it is seen that the small boiler has only 58.7 per cent. of the capacity of the large one per unit of length, which shows the large boiler to have nearly twice as much space for flues and water as the small one. 2. In your August issue you state that there are not many ten-wheelers built with 16-inch cylinders at the present time, but the New York & Western has lately received three of such engines, and they carry 180 pounds pressure. You state that their idea is, to favor the track; will you kindly explain in what way it will favor the track? A.—The engines referred to were built of the dimensions stated, for the purpose of keeping the weight down, and thus prevent injury to the permanent way.

(72) K. C. B., Seattle, Wash., writes:

I wish to know how to devise and read a gage that will measure the vacuum in the smoke box of a locomotive, and ask your assistance to help me out. Can such an instrument be made cheaply, or would you recommend that it be bought from the manufacturer? A.—A vacuum gage for your purpose can be made at a trifling cost by taking a glass tube with a bore of about one-quarter inch, and bending to a U-shape by heating it. The legs should be about eight inches long, and filled for half their length when vertical, with mercury. The bent tube is then fastened to a board, which in turn is secured to a convenient place on the engine, say at the smoke box. A piece of three-quarter-inch pipe is next passed into the smoke box from the side at a point about midway of the hight and width of the flues, and between the exhaust nozzles and flue sheet, leaving the inner end on line with the vertical center line of the nozzle. The outer end of the pipe where passing through the smoke box, is connected to one leg of the bent mercury tube by means of a rubber tube, and the other leg is left open to the atmosphere. This device is ready for use after marking a few horizontal lines on the board, from which the readings are taken. These lines are spaced one-eighth of an inch apart for a distance of two inches, or one inch above and one inch below the line of mercury in the legs of the tube. In operation the exhaust from the engine removes the pressure of the atmosphere from the closed leg, and the atmosphere entering the open leg, displaces the mercury on both legs, causing it to fall in the open one and rise on the closed side, an amount proportional to the intensity of the exhaust. If the mercury is displaced, say one-half inch, that is, one-quarter inch on each side, the vacuum or pull on the fire is measured by the expression $\frac{0.5}{2.04} \times 16 = 3.92$ ounces. The value 2.04 equals the hight of a column of mercury weighing one pound, and 16 representing the number of ounces in one pound avoirdupois.

EQUIPMENT NOTES.

(Continued from page 696.)

pany are building 500 freight cars for the Missouri Pacific Railroad.

The St. Charles Car Company are engaged on an order for three freight cars for the Texas Midland Railroad.

The six engines ordered by the Cape Town Railroad, South Africa, of Baldwin Locomotive Works, have been shipped.

The Baldwin Locomotive Works are building one 6-wheel connected engine for the Columbia & Puget Sound Railway.

The Michigan Peninsular Car Company are building 200 freight cars for the Chicago, Rock Island & Pacific Railway.

The Missouri Car and Foundry Company are building 200 freight cars for the International & Great Northern Railway

The Northern Pacific Railway Company have 300 freight cars under construction by the Haskell & Barker Car Company.

The Schenectady Locomotive Works are building 10 6-wheel connected engines for the Chicago & Northwestern Railway.

The Wells & French Company are working on an order for 52 freight cars for the St. Louis & San Francisco Railroad.

The Sierra Madre Construction Company are having 20 freight cars constructed by the Ohio Falls Car Company.

The Louisville & Nashville Railroad Company are having ten consolidation engines built at the Richmond Locomotive Works.

The Dickson Locomotive & Machine Company have one 6-wheel connected engine under construction for the Montrose Railroad.

The Burlington, Cedar Rapids & Northern Railway have two 6-wheel connected engines building at the Brooks Locomotive Works.

One 6-wheel connected engine is under construction at the Brooks Locomotive Works for the Buffalo, Rochester & Pittsburg Railway.

The Baldwin Locomotive Works are engaged on six 6-wheel connected engines for the Chicago, Milwaukee & St. Paul Railway.

Six 6-wheel connected engines are being built at the Baldwin Locomotive Works for the Rumford Falls & Rangely Lake Railroad.

Ten flat cars of 50,000 pounds capacity are under way at the Erie Car Works, Erie, Pa., for the Mt. Jewett, Kinzua & Riteville Railroad.

One 8-wheel passenger engine for the Buffalo, Rochester & Pittsburg Railway is being built by the Dickson Locomotive & Machine Company.

Two 8-wheel engines and two 6-wheel connected engines are under way at the Schenectady Locomotive Works for the Texas Midland Railroad.

Four hundred freight cars are being constructed by the Wells & French Company for the Minneapolis, St. Paul & Sault Ste. Marie Railway.

The Schenectady Locomotive Works are to build two 10-wheeled freight engines and two 8-wheeled passenger engines for the Texas Midland & Gulf Railway.

The Schenectady Locomotive Works are building twelve 16 x 24 8-wheeled engines, to be ready for shipment by September 1st, for the Kiushiu Railroad of Japan.

The Live Poultry Transportation Company have placed an order for 27 cars with the Terre Haute Car Manufacturing Company. These cars are to be 34 feet long inside and will carry 16,000 pounds of poultry.

An order has been placed with the Erie Car Works, of Erie, Pa., by the Golden Gate Oil Company for two combination box and tank cars, with a capacity of 60,000 gallons of oil, or a capacity of 60,000 pounds.

The Kansas City, Pittsburg & Gulf Railroad are having freight cars built as follows: 300 by the Missouri Car and Foundry Company; 400 by the Pullman Car Company, and 250 by the Barney & Smith Company.

There are three compound 12-wheeled engines under construction at the Schenectady Locomotive Works for the Butte, Anaconda & Pacific Railroad. They are said to be the largest of the "Mastodon" build of engine.

The Kansas City, Pittsburg & Gulf have bought six of the Grant engines which the Siemens & Halske Co. completed and have had in stock the past few months. These were a part of the original Chicago, Burlington & Quincy order.

An order for ten moguls and one 8-wheeled passenger engine has been placed with the Brooks Locomotive Works by the Illinois Central Railway. The same road has also ordered four 10-wheeled passenger engines, and five moguls from the Rogers Locomotive Works.

The New York Equipment Company are furnishing through the Brooks Locomotive Works, two Mogul engines to the Jalapa & Cordova Railroad, also two passenger locomotives to the Mexican & Southeastern Railroad. They are also getting ready for shipment, a large passenger engine and a ten-wheel freight engine for the United Counties Railroad of Quebec, Canada. The above equipment company recently furnished the president of the Quincy Route with a private car.

The Keystone Axle Works, which have been under construction at Beaver Falls, Pa., for sometime, were put into operation last month and turned out a class of axles which is likely to revolutionize the business of axle making. By this method, the axles are rolled under an immense mass of metal weighing 123 tons. Tests of the axles made in this way, showed them to be of a very superior character. Mr. George W. Morris, a well-known connection of the A. French Spring Company, of Pittsburgh, is president of the company and he may be depended upon to push the axle into popularity as fast as its merits will allow.

It appears to us that inventors in Australasia have a tendency to follow American lines in the improvement of the locomotive. We have received a description of an invention for the prevention of smoke and saving of coal which has a very familiar appearance. The plan is to heat the gases supplied to the fire-box, and this is done by drawing the air through an outside casing to smoke-stack and smoke-box. There is also a feed water heater located in the smoke-box to utilize some of the heat gases passing through the tubes. Both these inventions have been tried in this country long ago, and tried repeatedly.

We received a notice from Mr. H. W. English, master mechanic of the Birmingham Railway, Birmingham, Ala., some time ago saying that he wanted a bound volume for 1895. Not having a volume left, we put a notice in the paper, intimating to our readers as to what Mr. English wanted. About the beginning of last month, we received a letter from him saying that he had already received over 70 answers to the notice, and they were still coming. He wished us to try and stop the flood, and this is to certify that Mr. English has got all of the 1895 literature that he desires.

At the regular quarterly meeting of the board of directors of the Davis & Egan Machine Tool Co., Cincinnati, O., July 24th, a dividend of 3 per cent. was declared to all stockholders of record. This was the ending of their fiscal year, and they report having done a profitable business during the past twelve months, fully 75 per cent. of which was export.

An enterprising reporter in Bangor, Me., sent telegraphic dispatches all over the country a few days ago, intimating that a thirsty elephant had nearly been the means of stalling a train. According to the report, the elephant was in a car next to the engine where there was an opening through which he could thrust his trunk. He reached over, and lifted the lid off the water tank and filled himself up to such an extent that there was a serious shortness of water before a water station was reached.

The Union Pacific officials are pluming themselves on a new long distance record. Engineer Thomas Grogan, with engine 890, pulled a special from Evanston, Wyo., to Omaha, 955 miles, in twenty-four hours, including all stops. This is claimed to be the record long run for a single engine. The final spurt of the run was a remarkable burst of speed, the distance from North Platte to Omaha, 291 miles, being covered in 279 minutes, at the rate of 63.49 miles per hour. The engine was built at the Omaha shops.

The highest viaduct in the world is approaching completion on the new Prussian State Railway. Its hight is 353 feet and the span of the center arch 556 feet. Until now the celebrated Douro Bridge at Oporto, in Spain, has held the record with a hight of 204 feet, and a central arch span of 525 feet.

Bids were opened by the United States government Tuesday, August 3d, for a large equipment of machinery for the navy yards at Port Royal, S. C. The Davis & Egan Machine Tool Co., of Cincinnati, O., were awarded the contract for several of the machine tools.

The New York Elevated Railroad Company are making tests with the Hardie compressed air locomotive. The engine works very satisfactorily, and promises to be a successful rival of the trolley and other methods of transmitting power by electricity.

The Baltimore & Ohio Southwestern are painting all of their city ticket offices "royal blue" with gold and silver trimmings. The combination has proved to be successful and attracts the attention of a great many people.

By changes in the track of the second division of the Baltimore & Ohio Railroad in the form of straightening curves and reducing grades, the average number of cars per train has been increased from 20½ to 40.

The wheels of industry are beginning to whirl, and the effect is that many locomotives which have been idle or nearly idle for years are making good mileage. There is going to be long hours directly in the machine shops and engine houses, and men will be overworked to keep the power in running order. In connection with the coming activity of business we wish to direct the attention of master mechanics to Smith's Duplex Boring Bar, illustrated on page 686 of this paper. A tool which bores out a set of engine cylinders in two or three hours must prove of very great value to railroad companies when engines are scarce. Under old methods the boring of a set of cylinders took as many days as the Smith machine takes hours. By its use two days' service of a locomotive can usually be saved.

President Diaz of Mexico has determined to put down train robbing and wrecking in that country, and what President Diaz makes up his mind to do is generally done. He has had a law passed which takes from highwaymen the right of trial guaranteed to others accused of crime. People are classed as highwaymen who do anything to derail trains, damage locomotives or cars, or in any way interrupt railroad telegraph or telephone communications. When they are caught in the act, the law gives the officers of justice permission to shoot them without any trial.

Catalog No. 33 of the Newton Machine Tool Works, Philadelphia, is a 180-page book, with about all the varieties of heavy milling machines you ever thought of, and some you didn't. Besides these, there are multiple drills, cold-metal sawing machines, slotters, boring mills and special shapers. All the Newton tools have plenty of iron in them, which is quite a recommendation to railroad men, who have had to get along with some of the weak-kneed machines of former days.

The London & Northwestern were lately fined ten shillings, because a switching locomotive emitted sufficient smoke to cause a nuisance. The company's officers protested that the fireman was the guilty person and that they were not responsible for the nuisance as the engine was equipped with the best smoke preventing appliances. They appealed the case to a higher court, and railroad managers on the other side are awaiting the decision with keen interest.

The Merits of Lead Paints and Dixon's Silica-graphite Paint Compared, is the name of a pamphlet recently issued by Joseph Dixon Crucible Company, Jersey City. The pamphlet consists of a spirited discussion of the relative merits of lead and graphite paints, and a defence of the latter, against misrepresentations of rival interests. Persons in any way interested in good paint will find interesting reading in this pamphlet. Send for it.

The sixth number of "Easy Lessons in Mechanical Drawing and Machine Design," by Mr. J. G. A. Meyer, has been received, and contains a description and drawings of the different parts of a stationary engine. The price of this book is 50 cents a number, and it should be studied by all who desire a complete knowledge of machine design. Published by the Arnold Publishing House, 16 Thomas street, New York.

The annual meeting of the Traveling Engineers' Association will be held in the Chicago Beach Hotel at Hyde Park, Chicago, commencing September 14th. A very attractive programme has been provided. Good hotel accommodations can be easily secured at low rates, and a large attendance is expected.

"Fragrant Whiffs" is the title of an illustrated catalog we have received from Jose Almarez & Co., Norriston, Pa., who make a specialty of manufacturing cigars to suit the refined taste of railroad men. It looks from the prices quoted as if the lovers of the weed would gain by sending for the catalog.

William Waltke & Co.'s lava soap is said to be the best thing ever tried for removing oil and grime from the hands and faces of engineers, machinists and others who require hard washing. The address of this company is St. Louis, Mo.

It is a curious thing to find the master mechanic of a railroad, which has adopted the master mechanics' standard gage for sheet metal, reporting that the material he uses for boiler jackets is a certain number of the Birmingham wire gage.

A quarter of an inch increase in the width of beltage on a lathe or other tool will often increase the production ten per cent. It is a wonder that the proper proportion of belts does not receive more attention.

The seventh annual convention of the Association of Railway Superintendents of Bridges and Buildings will be held at the Brown Palace Hotel, Denver, Colo., beginning Tuesday, October 19th.

Work on the Panama Canal.

Politicians and others interested in the Nicaragua Canal scheme keep the proposed enterprise constantly before the American public, but we hear remarkably little nowadays about the Panama Canal. There is a belief among many Americans that the failure of the first Panama Canal Company led to the abandoning of the work, and that nothing more has been done. This is a mistake. There have been about 5,000 men working on the canal for about three years, and they are making good progress. The original plans of the canal have been greatly modified, and the intention now is to employ locks to carry the ships over the high ground instead of cutting to the sea level the hill which has to be crossed. The new canal company, formed in Paris in 1894, intend by means of ten locks rising to an altitude of 133.8 inches. It is also proposed to greatly reduce the width and depth of the waterway.

The amount of capital is yet limited; but if the new canal company obtains all the funds they need, it is expected that ships will be crossing by the canal in a few years. The canal will effect great influence on the transportation business between the east and west coasts, and may make the lot of our transcontinental lines a little harder than it is now, and that is hard enough.

Some of the fears expressed in our July issue regarding the exposed third rail of the New Haven electric system are being realized, and several accidents are reported, fortunately none of them being fatal. It must, of course, be understood that people have no right to be where the rails are exposed, as the ground belongs to the railroads, which is more than can be said for the great majority of electric roads; but people have been used to trespassing on railroads, and the habit cannot be broken in a day. While it would probably be difficult to recover damages for accidents of this kind, it would seem to be better to fence the road than to incur the expense of lawsuits and the enmity of the public. It does not pay to court enmity when it can be avoided.

The Schenectady Locomotive Works are building ten more heavy compound ten-wheelers for the Northern Pacific. They are also building three compound twelve-wheelers for the Butte, Anaconda & Pacific. This is practically the same engine as was illustrated in the March number of "Locomotive Engineering." The Butte, Anaconda & Pacific Company, which has a great deal of mountain track, borrowed one of the Northern Pacific twelve-wheelers and it did the work so well that the order mentioned was the result.

The Mason Regulator Company, Boston, Mass., have received large orders for their standard locomotive reducing valves from the following: Penna. R. R., Southern Ry. Co., C. & W. Mich. R. R. and N. Y., N. H. & H. R. R. They also filled an order from the London & North Western Railway of London, England, which is the only road that has adopted steam heat in that country. Mason reducing valves are being used entirely by the Boston & Maine Railroad for their new station at Concord, N. H.

The Boston Belting Company have published a neat illustrated catalog and price list of their mechanical rubber goods for railroad use. The catalog is 3½ x 6 inches, the smallest standard size and is quite convenient for the pocket. Besides giving illustrations and descriptions of nearly all rubber goods used by railroad companies, it has a number of blank leaves for memoranda. Foremen and others will find this a very convenient book.

Messrs. R. D. Wood & Co., Philadelphia, have just issued a 72-page catalog of their hydraulic tools, cranes and machinery, which is very interesting to those using such appliances. There is hardly a department in the railroad or locomotive shop which cannot use some of these tools to advantage, from cranes to portable riveters.

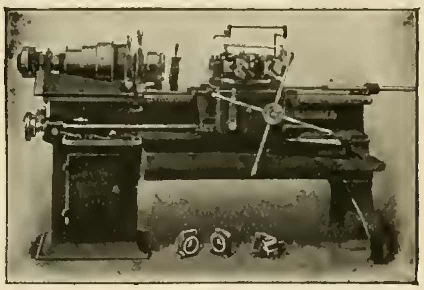
Mr. F. W. Horne, who is now on his way to Yokohama, Japan, has placed a large order for lathes, planers, shapers, milling machines, etc., with The Davis & Egan Machine Tool Co., of Cincinnati, Ohio. He will represent that company in China and Japan.

The Mexican Central have ordered a Tabor molding machine for their iron foundry. They have had one of these machines in their brass foundry for several years and it has given so much satisfaction that this new order is the result.

Another patented machine for sawing off rails has been assigned to the Q. & C. Company, of Chicago, Ill. They are acquiring a complete line of these machines, and evidently mean to have the best there is.

The practice of ordering new power with wheels of a compromise diameter, that is, of a size that will permit of use in both passenger and freight service, seems to be revived lately in the heavy equipment on several prominent roads. This tendency is toward a larger wheel diameter for freight engines.

INDEX TO ADVERTISEMENTS.



Buyers' Finding List.

AIR BRAKE HOSE.
- Boston Belting Co., Boston, Mass.
- N. Y. Belting & Packing Co., New York.

AIR BRAKES.
- Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
- Clayton Air Compressor Works, New York.
- Ingersoll-Sergeant Drill Co., N. Y. City.
- Norwalk Iron Works Co., South Norwalk, Ct.
- Pedrick & Ayer Co., Philadelphia, Pa.
- Rand Drill Co., New York.

AIR LIFT PUMPS.
- Clayton Air Compressor Works, New York.

AIR LOCOMOTIVES.
- Baldwin Locomotive Works, Philadelphia, Pa.

AIR PUMP GOVERNORS.
- Mason Regulator Co., Boston, Mass.

ARCH BARS.
- Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
- Carey Mfg. Co., Philip, Lockland, O.

AXLES.
- Cambria Iron Co., Philadelphia, Pa.

BALANCED SLIDE VALVES.
- Am. Bal. Slide Valve Co., San Francisco, Cal.
- M. C. Hammett, Troy, N. Y.

BEARING METAL.
- Ajax Metal Co., Philadelphia, Pa.
- Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
- U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
- Peerless Rubber Mfg. Co., New York.

BENDING MACHINES.
- Long & Allstatter Co., Hamilton, O.

BICYCLES.
- Pope Mfg. Co., Hartford, Conn.

BOILER AND FIREBOX STEEL.
- Shoenberger Steel Co., Pittsburg, Pa.

BOILER COVERINGS.
- Carey Mfg. Co., Philip, Lockland, O.
- Keasbey & Mattison Co., Ambler, Pa.

BOILERS.
- Brooks Locomotive Works, Dunkirk, N. Y.
- Cooke Locomotive & Machine Co., Paterson, N. J.
- Pittsburg Locomotive Works, Pittsburg, Pa.
- Richmond Loco. & Mach. Wks., Richmond, Va.

BOILER TUBES, LOCOMOTIVE.
- Allison Mfg. Co., Philadelphia, Pa.
- Tyler Tube & Pipe Co., New York.

BOLT THREADING MACHINERY.
- Acme Machinery Co., Cleveland, O.
- Manning, Maxwell & Moore, New York.

BOOKS.
- Audel & Co., New York.
- Griffin & Winters, Chicago, Ill.
- H. C. Baird & Co., Philadelphia, Pa.
- Montgomery, Ward & Co., Chicago, Ill.

BORING MACHINES.
- Manning, Maxwell & Moore, New York.
- Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS.
- Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
- Ramapo Iron Works, Hillburn, N. Y.
- The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
- Ajax Metal Co., Inc., Philadelphia, Pa.
- Paul S. Reeves, Philadelphia, Pa.

BUFFERS, BLOCKS, SPRING.
- Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
- Williams, White & Co., Moline, Ill.

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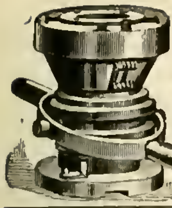

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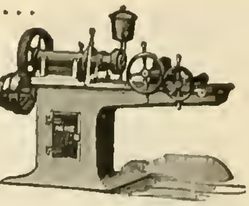

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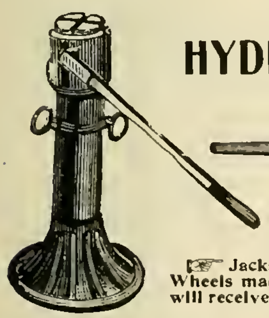

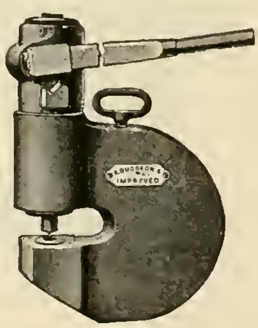

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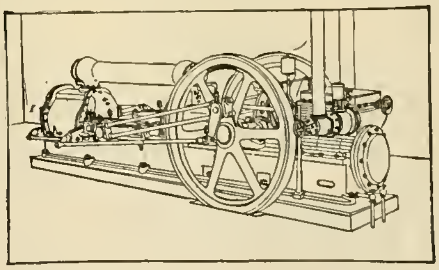

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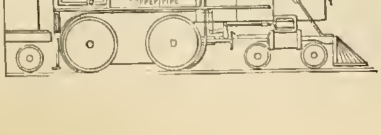

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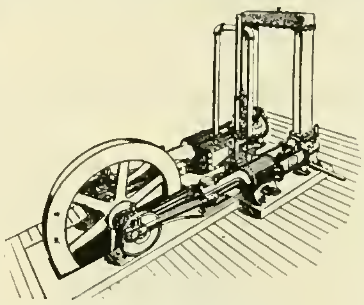

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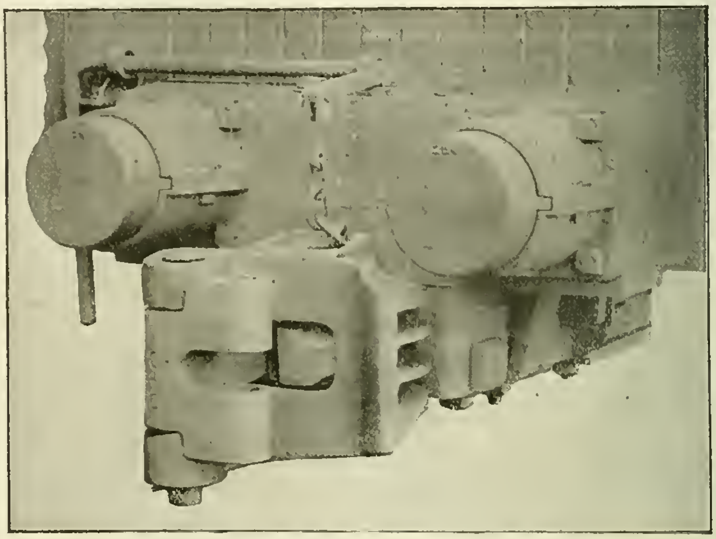

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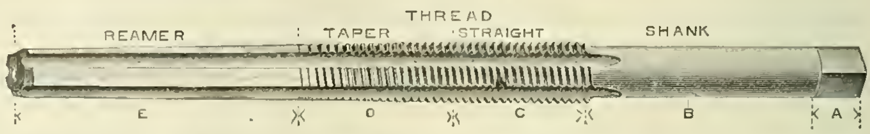

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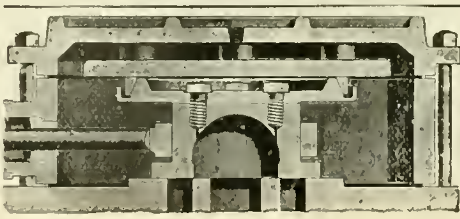

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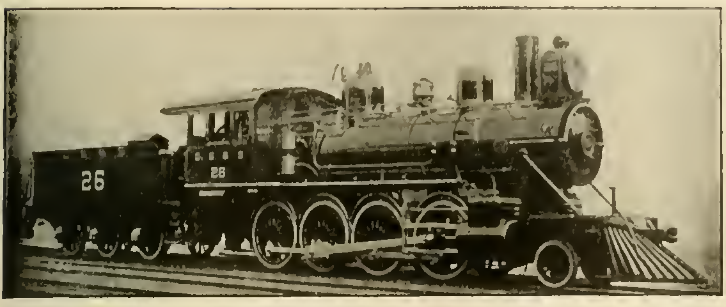

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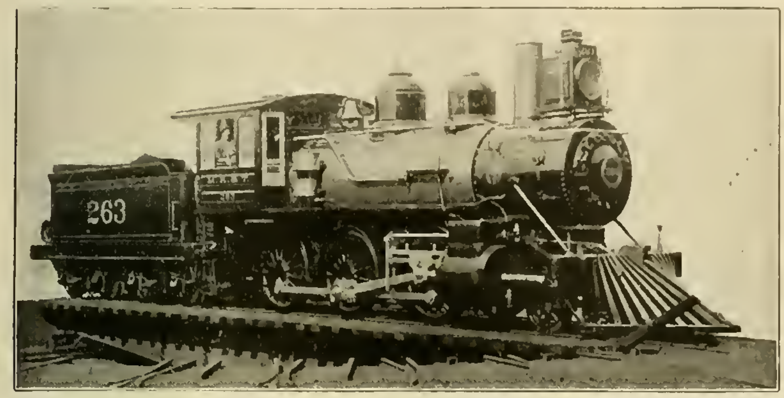

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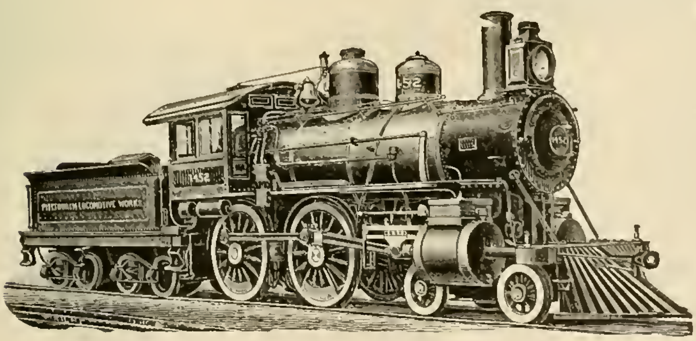

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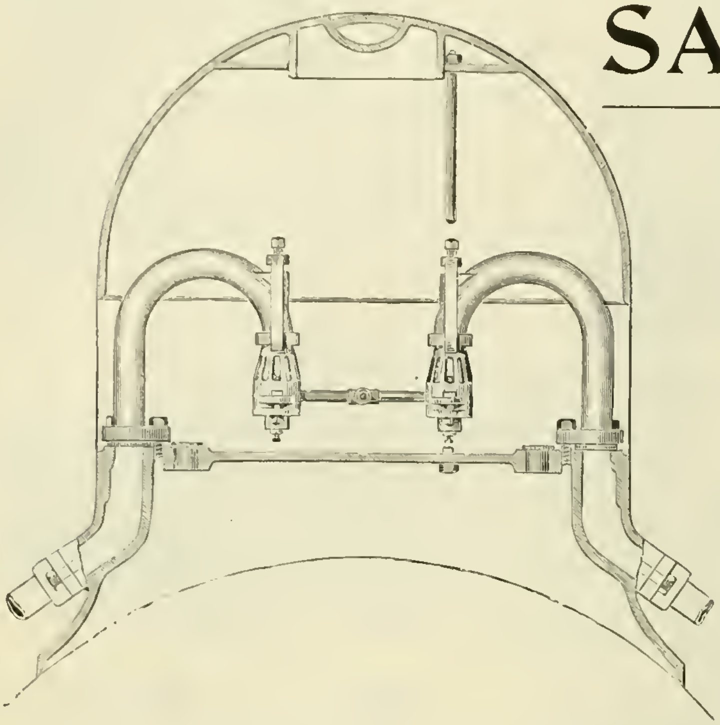

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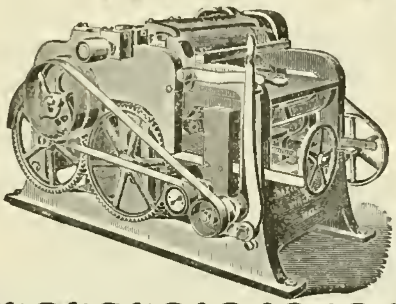

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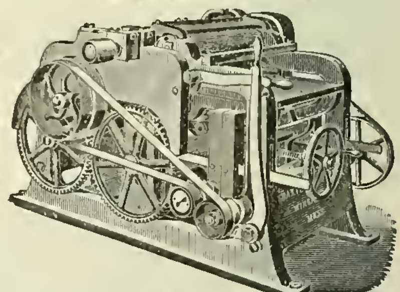

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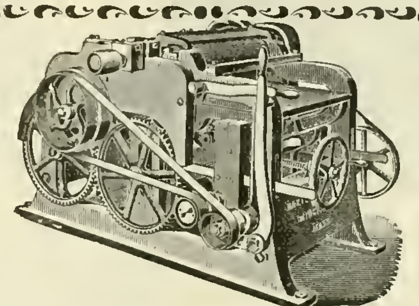

Cutter head bearing of ample size, accurately fitted. Those on P-4 Planer are 10 in. long x 2 in. diam. Genuine Babbitt boxes, bored and hand scraped.

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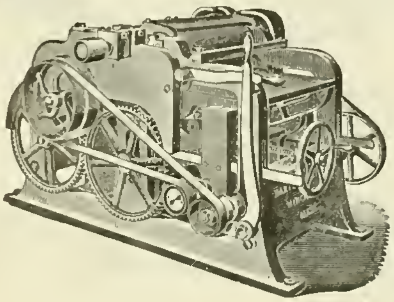

It will afford us much pleasure to answer you more fully, and to refer you to well-known houses (who know a "good thing" when the cover is off,) if given the opportunity.

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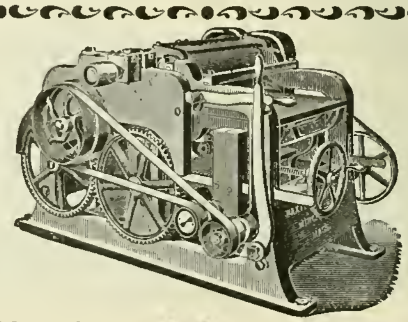


LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.
[Trade-Mark Registered.]
Vol. X. NEW YORK, OCTOBER, 1897. No. 10

Engine With Double Stack—London & Northwestern Railway.

Our illustration of the machine with the double stack shows a 17 x 24 engine, on which experiments are at present being made to determine what advantages there are in the double opening over the single. In outward appearance the stack looks like an ordinary straight stack flattened at the sides, but constructed so as to have two openings for the exhaust, one of each passing into each opening in the stack.

ENGINE WITH DOUBLE STACK—LONDON & NORTHWESTERN RAILWAY.

The smoke-box is divided into two separate chambers by means of a horizontal plate. One of the stacks passes down through the partition into the bottom chamber, causing the exhaust to induce a draft through the lower tubes; the exhaust through the other stack making a pull through the upper tubes. A device similar to this has been fitted to the "Iron Duke," the latest type of locomotive built at Crewe. For the cut and particulars of this novel front-end practice, we are indebted to "The Locomotive Magazine," London.

One Method of Handling Flues.

The tank shop of the Chicago & Northwestern shops at Chicago leaves an agreeable impression on the mind of an observer for its clean and generally well kept look, and the system of taking care of the flue work in particular. All the flue tools, the welder, the swager and the tester are massed in one end of the shop, in the way of nothing and nothing in their way, a situation rather the exception than otherwise, and invariably noticed when encountered.

An accessory for keeping the floor space clear and one remarkable for its scarcity in flue work, is the revolving rack for holding flues from the time they leave an engine until returned to it. This rack consists of a flanged tank iron base, circular in form, through which passes a shaft resting on a step let into the flooring, the top of the shaft being carried in a box secured to the roof truss. Three radial partitions are secured to the base and shaft and form a pocket in which to hold the flues, which are better in such a place than on the floor, especially in confined situations.

The Santa Fé Railroad have just completed their new car shops at Topeka, Kan. These are said to be thoroughly modern in every respect. The cost is estimated at $60,000.

Twelve-Wheeler for Buffalo, Rochester & Pittsburg Ry.

The Brooks Locomotive Works have recently turned out some heavy power for the above road, and, as shown by our engraving, an engine that has grown in popularity among operating officers on hilly roads. Careful attention to all details likely to enhance the efficiency of these engines as factors in freight transportation, is plainly evident in a study of the proportions. Prominent among these is the boiler with its liberal heating surface, giving assurance that the rated boiler pressure can be depended on to furnish a starting power of 30,000 pounds at the rail. The engines were built in accordance with the following specifications:

Type of engine—Twelve-wheeled.

Firebox, length—113 inches.

Firebox, width—37⅞ inches.

Firebox, depth—77 inches, front; 74 inches, back.

Tubes, number—324; diameter, 2 inches; No. 11, B. W. G.

Heating surface, tubes—2,106 square feet.

Heating surface, firebox—225 square feet.

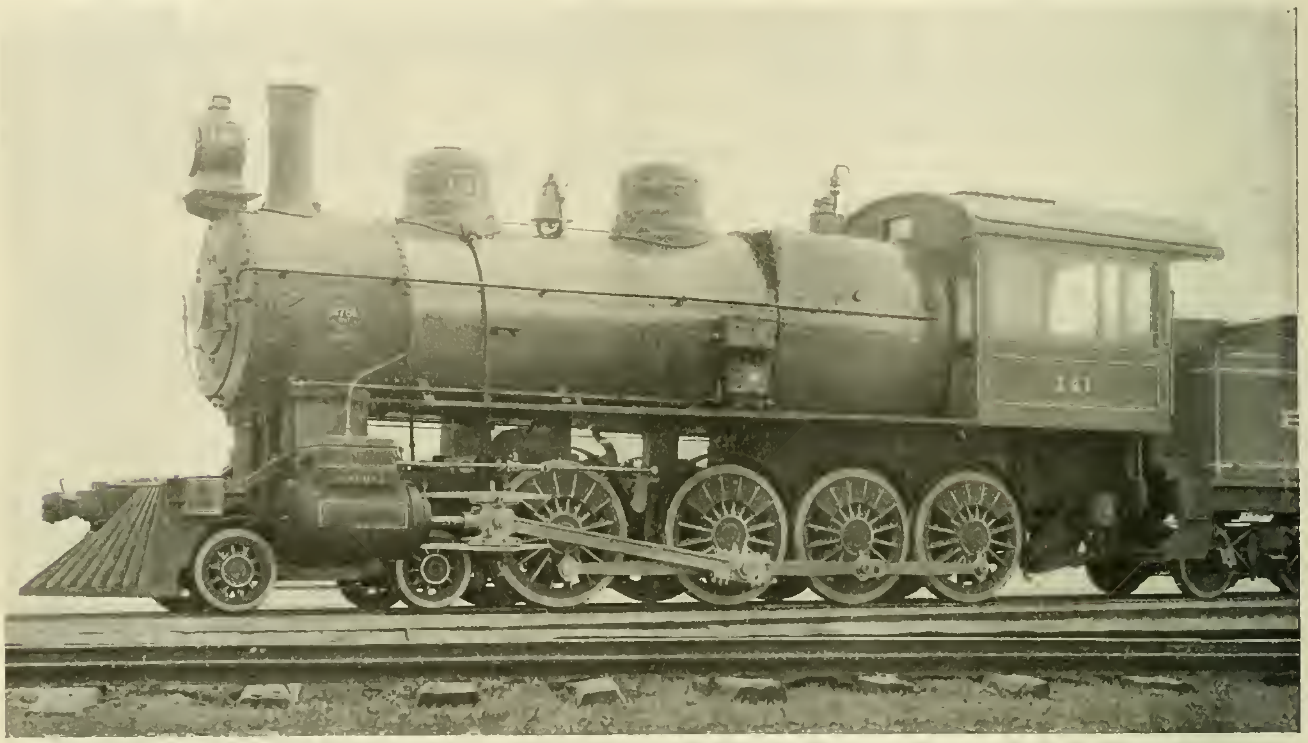
Heating surface, total—2,331 square feet.

Grate surface—30.4 square feet.

Weight, in working order—172,000 pounds.

Tender wheels, number—Eight; diameter, 33 inches.

Tender wheels, make—Krupp No. 4, O. H. steel tired.



TWELVE-WHEELER FOR BUFFALO, ROCHESTER & PITTSBURG RAILWAY.

Fuel—Bituminous coal.

Cylinders—21 inches diameter, 26 inches stroke.

Slide valves—Richardson.

Driving wheels, diameter over tire—55 inches.

Driving-wheel tires—Midvale, O. H. steel.

Driving-wheel centers—Cast iron.

Engine truck wheels—Krupp No. 3, O. H. steel tired.

Engine truck wheels, diameter—28 inches.

Boiler, type and material—Belpaire, Carnegie steel.

Boiler, diameter outside of small ring—68 inches.

Boiler pressure—180 pounds.

Boiler covering—H. W. Johns sectional asbestos.

Firebox, above frames, material—Carnegie steel.

Tender, capacity for water—4,500 gallons.

Tender, capacity for coal—Eight tons.

Metallic packing throughout.

Bearings—Phosphor bronze.

Brakes—New York, No. 9 G.

Safety valves—Kunkle's 3½-inch.

Lubricators—No. 9 Nathan.

Injectors—No. 10 Monitor, 1888.

Gages—Ashcroft.

Trojan couplers front and back; steel smoke-box, front and door; Leach's sand blast; brick arch supported on water tubes; double riveted mud ring.

On the Grampian Hills, the same where "Norval's" paternal ancestor fed his flocks, it is said the violence of the wind is so severe that it has been known to bring to a full stop trains running north from Perth.

The Holman Engines and the South Jersey Railroad.

The "true inwardness" of some of the stock selling schemes of doubtful devices is often amusing, especially if you haven't bought any of the stock yourself; if you have, you are more apt to be mad than to be amused.

It will be remembered that the advertisements for stock selling announced that two engines had been ordered by the South Jersey Railroad and been endorsed by Mr. C. A. Beach, the general superintendent, his letter being used in the advertisement as evidence that the engines were approved by practical railroad men, even if "Locomotive Engineering" and other papers had shown the fallacy of their principle and design.

It now appears that the South Jersey Railroad did not order the engines and did not pay for them, Mr. Holman paying for them himself, in advance, having obtained permission, presumably from Mr. Beach, to use the name of the South Jersey road to have it appear that they had been adopted by an operative railroad.

This may be business from a stock-selling point of view, but it will hardly be endorsed by railroad men generally.

At the Schenectady Locomotive Works they run their milling cutters over six lineal inches of surface per minute, with a periphery speed at cutting edge that comes within the fatigue limit, but this is for finishing cut only. For roughing they send the cutter over about one-half the surface in the same time.

Great Western Railway Ten-Wheel Freight Engine.

Our half-tone of the English ten-wheeler represents a type of power used on the Great Western in "goods" traffic, and will attract and interest the followers of locomotive development mainly because of its severely neat plain appearance and close adherence to native lines, so close as to leave no doubt of its paternity.

The enginemen of America, we believe, however, would find a grievance in what they consider the comparatively shelterless cab, even if the bad things that can be said for it, are more than offset by the convenience of getting at the driving and truck springs, in the event of a broken hanger. Inside connected, and boxes outside of the wheels is a combination seldom seen on this side.

A wide firebox is made possible by the outside frames, with a resulting heating surface not to be obtained with the inside frames, and heating surface at that end is where it is needed. The dimensions of steam ports will be seen to be a wide departure from American practice, which, for a 20-inch cylinder, would be at least four inches longer than given for this engine. General dimensions of the engine will be found below:

Type of engine—Simple.

Cylinders, diameter and stroke—20 x 24 inches.

Steam ports—14 x 2¼ inches.

Exhaust ports—14 x 3½ inches.

Driving wheels, diameter—54 inches.

Engine truck wheels, diameter—32 inches.

Boiler, diameter at small ring—54 inches.

Boiler pressure—165 pounds.

Firebox, length—77 inches.

Firebox, width—63 inches.

Firebox, hight—63 inches, front; 45 inches, back.

Tubes, number—150; diameter, 2½ inches; length, 14 feet 3⅜ inches.

Heating surface, tubes—1,402.06 square feet.

Heating surface, firebox—115.83 square feet.

Total heating surface—1,517.89 square feet.

Area of grate—35 square feet.

Water capacity of tender—2,600 gallons.

Wheel-base of drivers—14 feet 8 inches.

Wheel-base of engine truck—5 feet 6 inches.

Wheel-base of tender—13 feet.

Total wheel-base—48 feet 9¼ inches.

Total length over buffers—57 feet 10¼ inches.

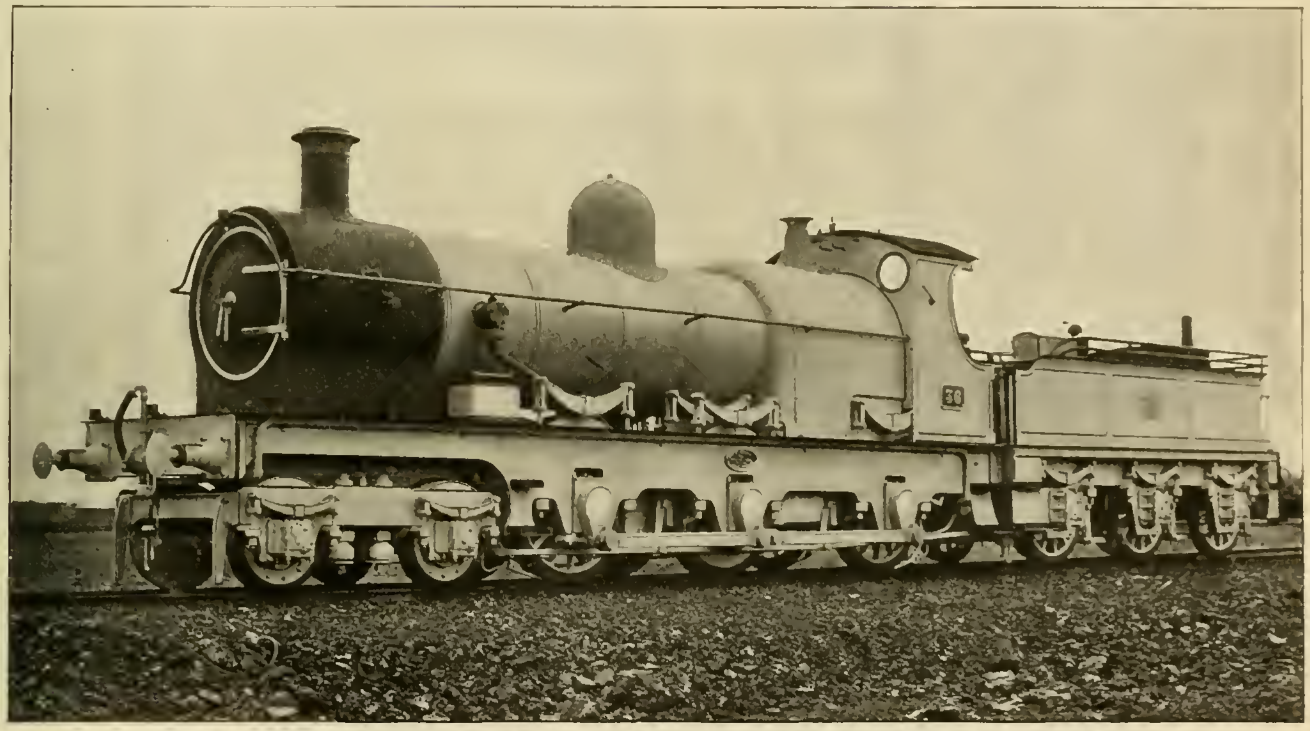
Weight on truck—27,552 pounds.

Weight on drivers—105,728 pounds.

Total weight of engine and tender—208,320 pounds.

Hight from rail to center of boiler—7 feet 8¾ inches.

This engine will exert a draw-bar pull of 23,700 pounds under almost any condition of the rail, with her ratio of adhesion to traction power of nearly 4.5, a proportion that will guarantee immunity from slipping in all cases likely to be met with.



GREAT WESTERN RAILWAY TEN-WHEEL FREIGHT ENGINE.

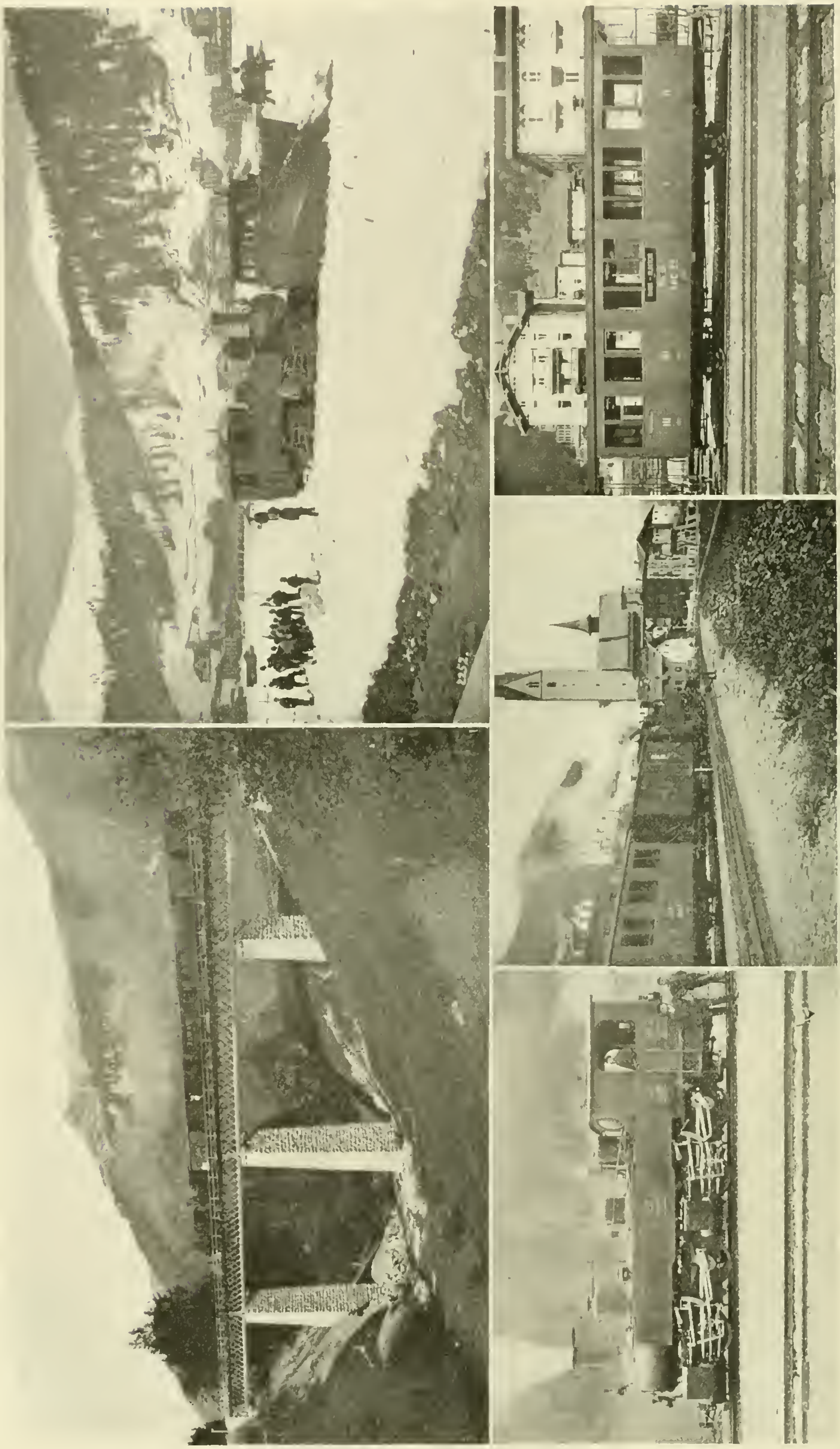
Hammered scrap is the practice for all heavy forgings at the Northwestern shops, Chicago. The cut off ends from the car axle forgings are worked up into driving axles, piston rods, crank pins, and main and side rods.

A Grinding Rig.

All kinds of dodges are practiced in railroad shops in order to avoid the exercise of muscle in grinding heavy jobs. Steam and dry pipe joints seem to call out the inventive faculties, and the man who is unequal to the task of getting the proper rotary motion wherewith to grind them, without taking the energy out of his own vital forces is the exception rather than the rule in the average shop. We have noted several ingenious schemes of the kind that have done the work well without involving any serious expense in the rig.

Among these is one we saw at work in the Great Northern shops at St. Paul. The movement to the dry-pipe, which was chained in vertical position, was obtained from a No. 3 Wright steam pump, from which the pump valves had been removed, and which was used about the shop to bore cylinders with air as a motor. A rod connecting with an improvised crank on the fly wheel of the pump, and extending to a clamp on the dry-pipe comprised about the cheapest arrangement for producing a vibratory action on the job, that we have seen used in that line of work.

Cast-iron guides and cast-iron crossheads are doing harmonious and satisfactory work on the Minneapolis & St. Louis Railway. Narrow transverse strips of soft metal are let into the wearing face of the crosshead to the number of four or five. Master Mechanic Tonge says he gets 150,000 miles of service to the 32d inch of wear, which makes it unnecessary to touch these parts between shoppings of the engines.



SCENES ON THE DAVOS-LANDQUART-THUSIS RAILROAD.

The Highest Adhesive Railroad in Europe.

BY SIMON LINDEN.

The Davos-Landquart-Thusis Railroad is the highest adhesive line in Europe. It is not a very extensive line, as far as length goes, being only 61.4 miles all in all, and in the United States many adhesive railroads have been constructed at a much greater altitude; but, still, as it is the largest thing of its kind in Europe, the readers of "Locomotive Engineering" might care to know something about it.

The line runs through a very mountainous part of Eastern Switzerland, and is of narrow (1 meter) gage. It joins the Continental standard gage system with Davos, a small, but celebrated health resort for lung patients, that lies at an altitude of 5,300 feet above the sea level.

The line is single track, and is laid out with rails weighing 50 1 pounds per yard. The sleepers are of wood, on the Landquart-Davos division, those of the Landquart-Thusis being iron, and in the future all relaying will be done with metal ties.

The road is very picturesque, and in many places grand scenery is to be met with. There are, however, no great engineering difficulties to be encountered, except, perhaps, in the ten miles before Davos, where there are three tunnels, the longest being 274 yards in length, a spiral one. Also, there is not much bridging work, the only large structure being near Klosters. At Klosters, the zig-zag part of the line begins, and the steepest gradients are encountered. The entire rise in the 34 miles between Davos and Landquart is 3,613 feet.

Although the trains are rather light, still, owing to the steep grades, heavy engines are in requisition (of course, heavy for the gage). These are of three classes. The first is composed of light Mogul tank locomotives, with three coupled wheels, and one pair of simple cylinders, weighing 31.7 tons. These locomotives are, however, too light for the heaviest grades, and work the Landquart-Thusis section, which is more on the level.

The second class is composed of two eight-wheeled tank compounds of 44.5 tons weight. A fair idea of their construction will be had from the accompanying photograph.

The link motion is all on the outside, on account of the narrowness of the frame; thus, all working parts are easy of access, but the effect is, to the eye, very much that of a locomotive turned inside out. However, this is no great drawback, especially as there is very little dirt and dust on the line.

The low-pressure cylinders are forward, and, together with the four forward coupled wheels, are on a revolving frame, the steamways being socketed together and turning pivotwise, thus diminishing the rigid wheel-base, and thereby facilitating the taking of curves. However, some trouble is experienced with the steam connection, leaks being the chief disorder. The principal dimensions are as follows:

Gage	3.28 feet
Hight top of stack from rail	12.31 feet
Weight of engine in working order	44.5 tons
Total wheel base of engine	21.64 feet
Rigid wheel base of engine	5.24 feet
Cylinders: four, compound.	
Cylinders, diameter:	
High pressure	1.03 feet
Low pressure	1.62 feet
Cylinder stroke	21.02 inches
Slide valve, Heusinger's system.	
Driving wheels, eight	
Driving wheels, diameter outside tires	3.44 feet
Boiler:	
Fuel, briquette coal.	
Working pressure	14 atm.
Material, iron.	
Material of firebox, copper.	
Thickness of plates	0.59 inches
Number of tubes	130
Brake, automatic vacuum	
Frame, outside.	
Tank, water capacity	3.4 tons
Tank, coal capacity	1 ton

Of the third class there are at present also two engines, in all essentials identical with the above described, the difference lying in the addition of a trailing wheel under the cab (to steady the engine, type II having a tendency to wabble), and slight divergence in the disposition and systems of safety valve, steam domes, etc.

These engines work very satisfactorily, having to haul four trains each way per day, of an average weight of 70 tons. The maximum speed is 27 miles an hour, the mean being 16 miles.

The rolling stock consists of passenger two-axle cars of 6 to 8 tons, and light goods cars of 10 tons capacity. All are provided with automatic vacuum, as well as powerful hand brakes; the passenger cars are steam heated. The couplers are of the ordinary Continental screw type, two being affixed to each bumper beam; between these are placed single bumpers with convex surfaces.

As there is a good deal of snow on the line in winter, the locomotives are all provided with small snow ploughs. A larger snow plough is used when the snow is very heavy. The line is plentifully ballasted throughout, hard limestone being the material used.

The engineers receive from 3,000 to 3,600 francs (or $600 to $700) a year, the firemen from 2,000 to 2,700 francs ($400 to $540)—a very poor salary, judged by American standards.

The accompanying photographs, taken for this article, will give some idea of the outward appearance of the rolling stock and country the railroad passes through.

Davos-Platz, Switzerland.

An Efficient Blacksmith Shop Tool.

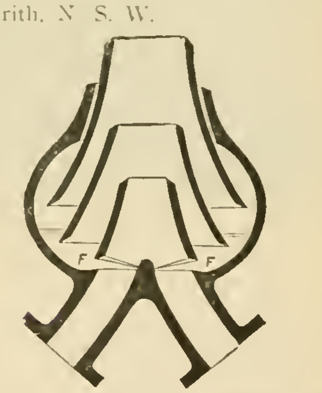
The science of forcing iron into intricate shapes by die work has received considerable attention at the Great Northern shops, St. Paul, where they have a Blakeslee upsetting machine with which to handle the problem, and the output of work with it covers such a wide range that any mention of it in detail is not possible more than briefly.

It is in the quality of work laid out on the dies, however, that we trace the prime cause of success in the tool. They are machined all over and faced with steel on their working surfaces, comprising on the whole one of the best and most mechanical exhibits of the kind to be found in any shop and one hardly ever seen in a railroad repair shop, but they pay because they are made to cover locomotive, car and road work, thus keeping the machine in commission every working hour in the day.

Among a few of the jobs that show the capacity of the machine, can be mentioned, crown bars, radial stays and patch bolts for locomotive work. All work on car draft rigging and brake appliances, and on road work it takes in switch rods and fish plates. In the case of the latter for connecting 56-pound with 75 pound rails, the plates must have an offset; the upsetter does the job with most beautiful accuracy. Like all machines of the kind, its worth is measured by the brains put into the devices that produce the results.

New South Wales Exhaust Pipe.

The curious form of exhaust pipe here shown was invented by Messrs. Stewart and Buckley, two railroad men residing at Penrith, N. S. W.



NEW SOUTH WALES EXHAUST PIPE.

The inventors claim that an improved smokebox vacuum results from the use of the pipe, and that a larger nozzle can be used which reduces the consumption of fuel.

The making up of freight trains on the tonnage basis is receiving the liveliest attention from motive power and transportation officials all over the country. Our tractive-power and also train-resistance computers are in great demand for this work, and their sale furnishes something of an index to the extent of the interest in the important matter of placing tons behind an engine.

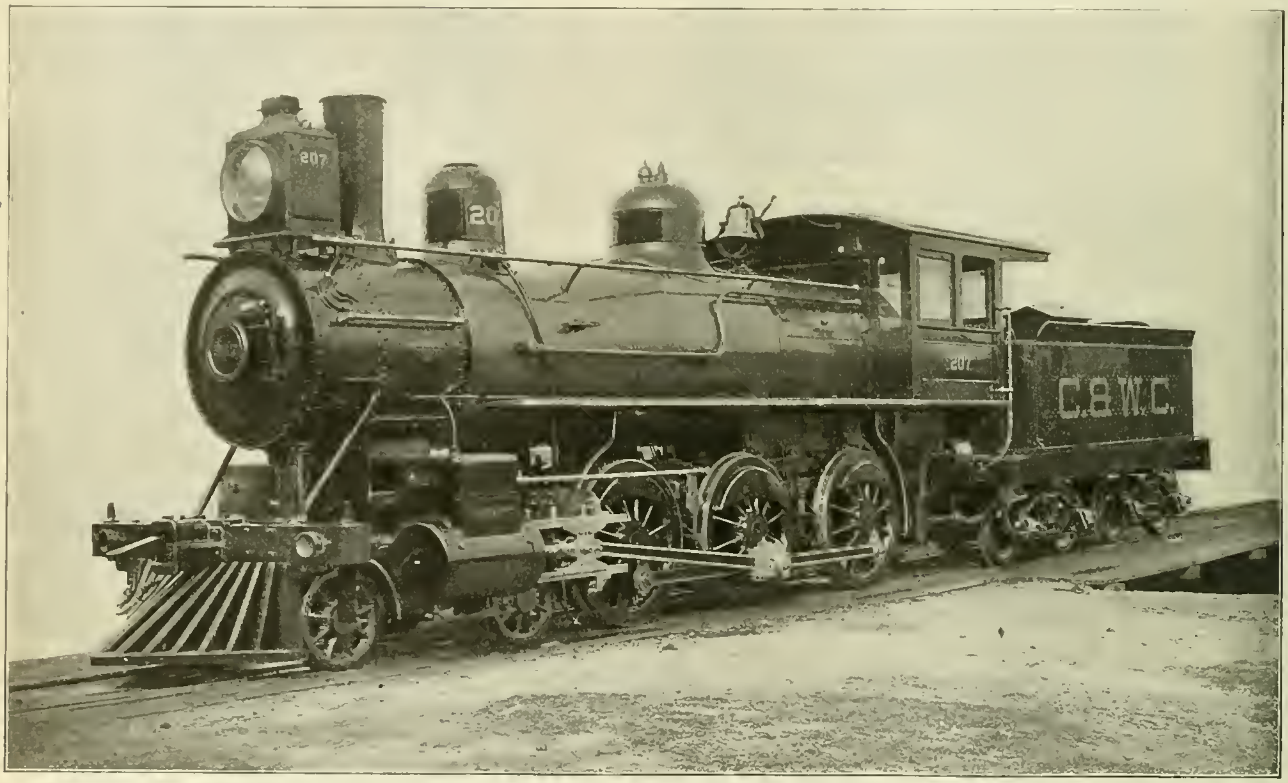
Charleston & Western Carolina Ten-Wheeler.

The ten-wheel freight engine shown in the accompanying engraving was built at the Richmond Locomotive and Machine Works for the Charleston & Western Carolina Railway, for use in heavy freight service. This engine was built for loads, as is plain from the boiler pressure and size of wheels and cylinders. Ideas of to-day in locomotive design are apparent to the observer of the picture, making it unnecessary to particularize, other than to give a general description of the engine, which is as follows:

Cylinders—18 x 24 inches.

Driving wheels, diameter—56 inches.

Driving axle journals—7½ x 8½ inches.



CHARLESTON & WESTERN CAROLINA TEN-WHEELER.

Boiler, diameter at small ring—56 inches.

Boiler pressure—180 pounds.

Firebox, length—96 inches.

Firebox, width—34 inches.

Tubes, number—215; diameter, 2 inches; length, 12 feet 11 inches.

Heating surface of tubes—1,456 square feet.

Heating surface of firebox—163 square feet.

Total heating surface—1,619 square feet.

Capacity of tank—3,500 gallons.

The Locomotive Gets There at Mount Holly.

The equipment of the Mount Holly road with electricity has been watched with considerable interest and a quiet little unofficial test made there last month is worth noting, as it shows that the old rheumaticky locomotive, which has been hustled to the scrap heap a hundred times—on paper—can get a hump on even now, if necessary.

Word was sent for the number 929 of the New York division (Pennsylvania Railroad), and it was sent to Burlington, no one knew what for. The 929 is a 17 x 24-inch engine with 5-foot drivers and carries 130 pounds of steam.

Arriving at Burlington she was coupled on to the dynamometer car and two others, making a three-car train. Then the 929 waltzed them to Mount Holly, a distance of 7 miles, and made 16 stops, in 18 minutes, a performance that would do credit to anything on wheels, and which is pretty good work for a type of machine with one wheel in the grave and the other a close second.

The next entry was one of the motor cars, a full length passenger car with a 100 horse-power motor on each truck, and which sometimes hauls two other cars for company. This time, however, she went it alone and although she tried her level best the referee announced 21 minutes as the time.

Those who know the road say that the two engines which formerly run it burned about 5,000 pounds of coal per day, while the power plant burns from 6,000 to 7,000 pounds at present. The force at present employed is also in excess of that in service on the two trains previously run, although the lower wage rate probably makes these expenses about alike.

While there is little doubt that the electric motor will be largely used for this class of service, it is very interesting to know that the aged and decrepit locomotive can still "do her turn" when it comes to fast suburban work.

The braking in a run of this kind would be a revelation to those engineers who "feel" their way into a station for the last half mile and who make two or three applications to each stop.

It was on the tenth day of February, 1852, that the construction train of the Lake Shore & Michigan Southern laid the last rail necessary to an entry into Chicago. The first train in—the construction train—was pulled by a little 7½-ton engine, the Gipsey, Fred. Avery, engineer, and Charley Metcalf, fireman. The engineer has been out of this vale of sorrow many years, but the fireman of that engine is as young as anybody today, after his experience of 45 years in railroad service. Still in the harness, on the Northern Pacific, he proposes to make a record as an old timer himself.

Superintendent of Motive Power McNaughton, of the Wisconsin Central, has recently thrown a boiler and a 25 horse-power engine that drove his boiler-shop tools, into retirement to make way for a rope drive, at a cost that, we think, could be easily covered by the second-hand value of the removed steam plant, not to mention the increased revenue due to saving the cost of attendance. These are the kind of economies that count.

Losing Time at Stations.

The question of fast train service on any railroad has one phase which does not seem to be carefully considered in all cases. It is too often the case that after securing a powerful engine and limiting the number of cars, the time scheduled is shortened and things hum—between stations.

The engine makes splendid time while running, but still the new schedule is hardly made in any case. Why? Because in too many cases the time that is saved by fast running is lost by unnecessary delays at stations. There are comparatively few roads where time is not lost in this way, and if care is taken it is easier and cheaper to save time at stations than by fast running.

Time is easily lost at stations, more easily than is realized, and the old joke about the conductor having a game of euchre with the station agent during the stop is simply but a little exaggeration of facts in many cases.

It is the speed in miles per hour, including stops that counts in getting over the road, and the "magnificent bursts of speed of 84.7 miles per hour," etc., do not count when a five minute stop is made where a minute or less would be sufficient.

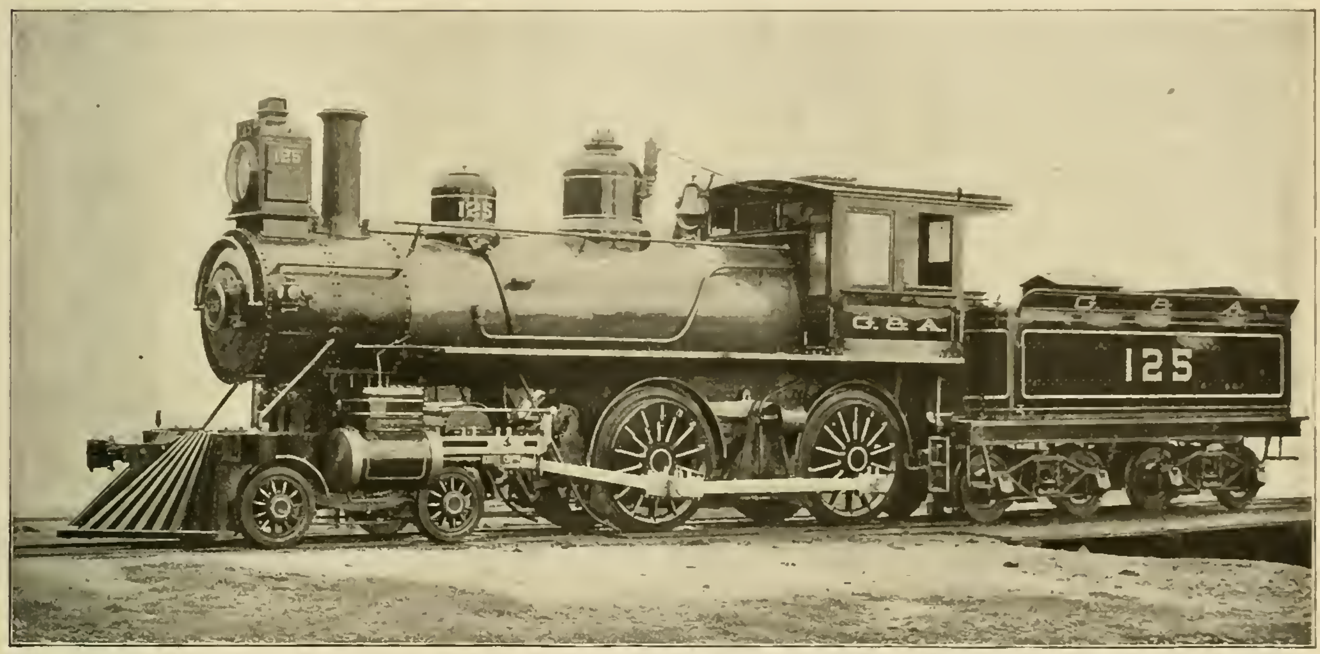
There are local trains being run in some parts of the country where five and six car trains average only 30 seconds to a stop—actual time of standing still.

The passengers soon get accustomed to it and appreciate the saving in time to them, realizing that while the three minute stop gives more time for chatting on the train, the shorter stop aids them materially in getting home more quickly. If this feature was looked after more closely there would not be the demand for such excessive high speed between stations, which is expensive from every point of view, from coal consumption to engine repairs.

Georgia & Alabama Eight-Wheeler.

A passenger engine combining in its make-up many of the best points of the standard American locomotive, is shown in our half-tone of the engine built for the Georgia & Alabama Railway by the Richmond Locomotive and Machine Works. The features that stand prominently out and assert themselves in every line, are the familiar ones of the type we have so long known as making an efficient, all-around machine for general railroad work. The accompanying figures fairly describe the engine's dimensions:

Cylinders—18 x 24 inches.
Driving wheels, diameter—62 inches.
Driving axle journals—8 x 9 inches.
Engine truck wheels, diameter—30 inches.
Boiler, diameter at smoke-box end—56 inches.
Boiler pressure—160 pounds.
Firebox, length—78 inches.
Firebox, width—34¼ inches.
Tubes, number—240; diameter, 2 inches; length, 10 feet 11 11-16 inches.
Heating surface of tubes—1,385.2 square feet.
Heating surface of firebox—151.6 square feet.
Total heating surface—1,536.8 square feet.
Driving-wheel base—9 feet 1 inch.
Wheel-base of engine—23 feet 5 inches.
Total wheel-base of engine and tender—46 feet 1¾ inches.
Weight on drivers—68,500 pounds.
Weight in working order—106,700 pounds.
Capacity of tank—4,000 gallons.



GEORGIA & ALABAMA EIGHT-WHEELER.

Another idol has been hit between the eyes, and hasn't recovered its breath enough to say a word of protest. All the nonsense which has been written about water-tube boilers being safer under high pressure than the fire-tube type, was snowed under recently by an able article in "The Locomotive," an excellent authority on boilers, showing conclusively that the safety of a boiler depends on its material, its construction and its care, rather than the type of boiler. This conclusion is the result of years of experience in inspecting and insuring boilers. Few boilers have harder service under high pressure than the boilers of locomotives, and yet, when they are properly cared for, they very seldom "let go" and raise Cain generally.

Some of our English contemporaries are loud in the praise of the Midland Company for introducing dining cars on their express trains. We have been used to this for so long that we almost forget it is anything unusual, and it may be well to remind ourselves that we enjoy more luxuries than we realize.

Several firms report increased business, among them being Paul S. Reeves & Co. and the Chester Steel and Foundry Co. The M., K. & T. shops at Sedalia, Mo., are reported to have been put on a 60-hour a week schedule.

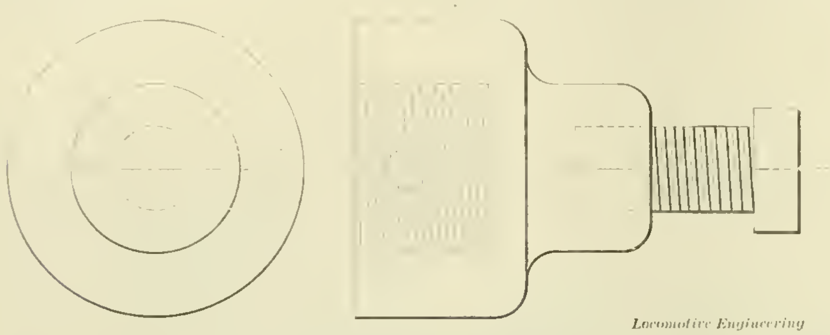
Some Michigan Central Kinks.

Two good examples of useful tools on lathe work are shown herewith, representing something more than a mere difference of manual effort in getting at results, a point that is too often not given due weight, since utility is easily sacrificed to convenience in a great many cases of so called special tools. The expanding chuck will be recognized as a good thing for work of the ring order, and especially packing rings.

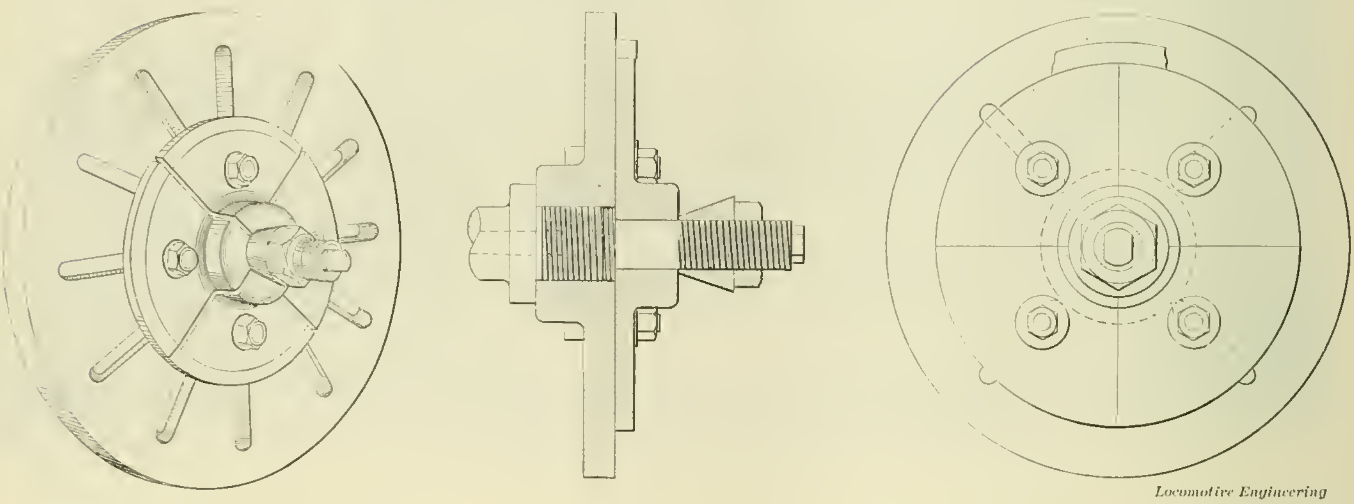
The chuck consisting of four sections, is held to the face plate by a bolt through each piece, the latter being forced against the inside of the ring by means of nut and cone which are carried on the stud that is shown screwed into the face plate. The sides of a ring will evidently be parallel if one faced side is against the face plate when the opposite side is faced. The chuck will drive a job against the severest trials of cut and feed, and its field is therefore widened to a degree that makes it now a necessity. There will of course be a difference of opinion among mechanics as to the relative value of this device and the heavy expanding mandrels so long in use before this was heard of, but this tool is very popular with those that use it.

Another scheme of the chuck kind is that for facing the inside of the heads of follower bolts. It is cheaply made of one piece, bored and threaded to fit the lathe spindle and applied thereto with a spanner wrench. The outer end is threaded to receive the follower bolt which is simply the correct size of the round iron headed, and threaded in the bolt machine. The bolt is screwed into the chuck as shown in the engraving, and the under side of the head is then faced. It is obvious that the bearing of the head thus faced, will be practically true with the thread. A saving over the turned bolt is plain. No centering or turning to size, and no waste of stock.

These little economy persuaders were gotten up by general foreman Case, of the Michigan Central shops at Jackson, Mich., who has put in operation one other plan that will be best appreciated by those that have once tried it, namely, using a small shaper chuck in which to secure work on his drill press tables. They are a decided improvement over the clamp system of holding work, because a job is quickly adjusted to the drill or boring bar center, and when put there, stays, inspiring a peaceful contentment in the operator, since he is not troubled with visions of a job torn loose and swept from the table to the floor, and a bent or broken drill to account for.



CHUCK FOR FOLLOWER BOLTS.



EXPANDING CHUCK.

On the Northern Pacific they have adopted the practice of placing asbestos fiber between the smoke arch and stack base. This permits of the use of one pattern of stack saddle on smoke arches, varying from 1 to 5 inches in diameter, without any fitting to the saddle whatever.

Historical Chart Number Ten.

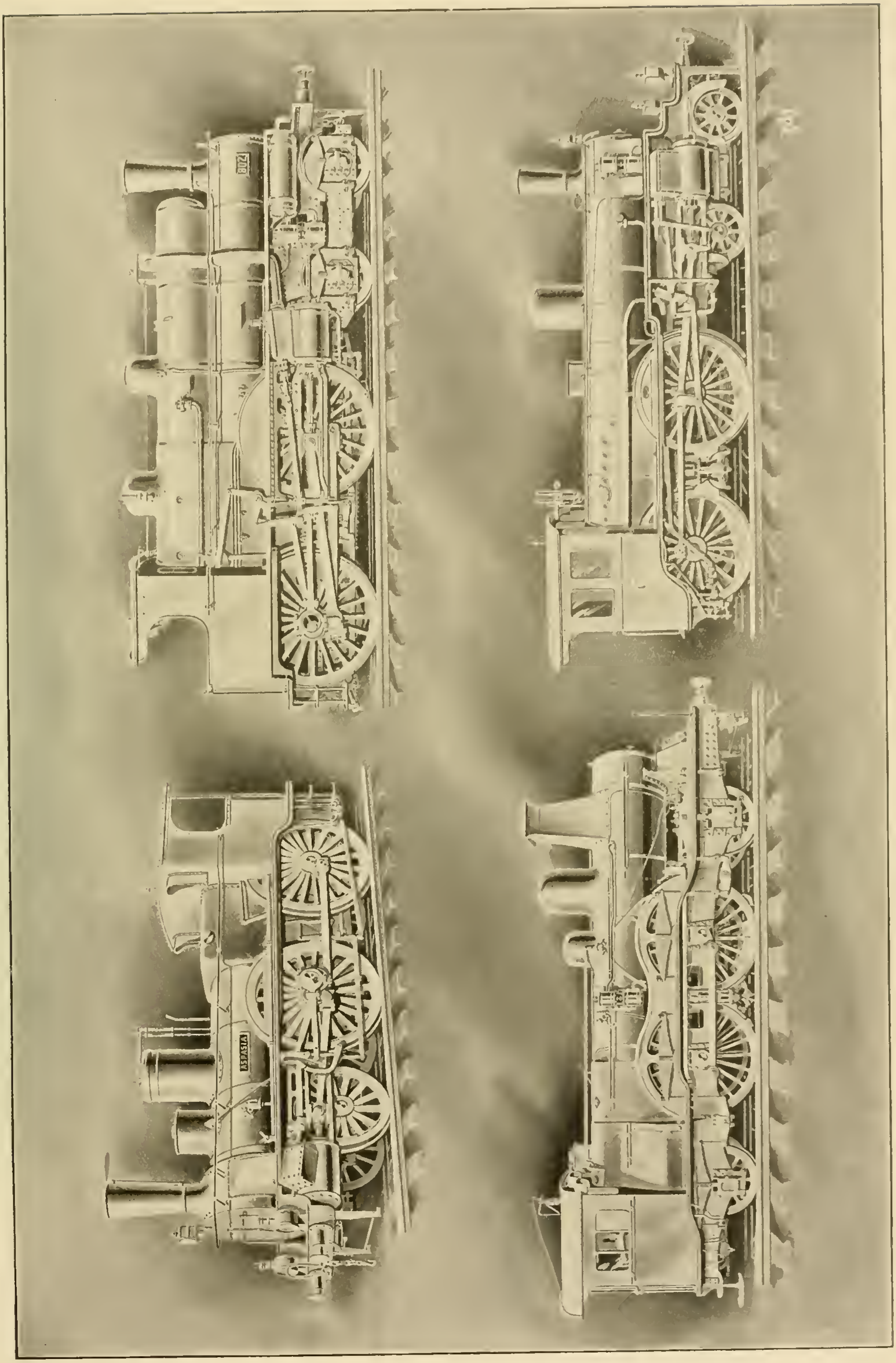
This chart shows a collection of Continental express engines which are interesting in many ways. In the upper left-hand corner is an Italian engine, the Aspasia, with four coupled drivers and large leading wheels, but no truck. The boiler is of the Belpaire type, the valve motion outside, as in many Continental engines. The dome and sandbox are evidently not designed for beauty. This is rather a peculiar wheelbase for an express engine, from our point of view.

The French engine, upper right-hand corner, is from the Eastern Railway of France, and, with the exception of the double-decked boiler looks thoroughly businesslike. The location of the cylinder and the outside valve motion look odd to us, but appear to get there nevertheless.

The Belgian engine, lower left-hand corner, is inside connected, and appears to have a combination of the Belpaire boiler and the Wooten firebox, while the stack would answer very nicely for a monument. The wheelbase is very similar to some of the "flyers" in this country which have been largely talked about in the last few years.

Last, but by no means least, is the German engine, which, with the exception of the outside valve motion and the absence of a pilot, would very readily pass for a modern American locomotive in wheelbase, counter-balance and all. The cab is in marked distinction from most European practice.

One noticeable feature is the presence of the air-pump, apparently the Westinghouse, on three of the engines, showing that efficient braking is appreciated abroad as well as at home.



Italian. Belgian.

French. German.

GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 10.

MODERN CONTINENTAL PASSENGER ENGINES.

American Express Locomotives.

In the course of three-quarters of a century, a vast wilderness on the American continent has been changed from gloomy, untrodden forests, dismal swamps and pathless prairies into the abode of a high civilization. Prosperous States teeming with populous towns, fertile farms, blooming gardens and comfortable homes have arisen from regions where formerly savage men and wild animals united to maintain sterile desolation. The most potent factor in the beneficent change effected has been the construction of railroads.

There are numerous navigable rivers and lakes furrowing the great continent, but geographically they are far apart, and there is no means of reaching vast regions except by land transportation.

Long before a railroad was built anywhere, American engineers and public men perceived the possibilities of the steam engine as a means of accelerating land travel, and this century was a very few years old when projects began to be agitated in different States, to construct railways or tramways, on which the steam engine could be employed as motive power.

More than a century has passed since Oliver Evans, the inventor of the high-speed, high-pressure steam engine, predicted that his engine would some day enable passengers to leave Washington after breakfast, dine in Philadelphia and sup in New York. The distance is 229 miles, and it is now traversed by numerous express trains on the Pennsylvania and Baltimore & Ohio railroads in about five hours.

When Evans' prediction was made, it took a week to travel over the atrocious roads that separated New York from Washington, and it seemed absurd to suppose that the journey could be made in a day; but Americans have always been very cordial in their welcome of improvements. They have always reposed great faith in the men who showed themselves capable of inventing or improving mechanical devices to lighten human toil or lessen animal drudgery. While the natural pessimist might say that the promised mechanical revolution smacked of the miraculous or bordered upon the ridiculous, the mass of the people were ardent believers that Oliver Evans' prediction would come true, and their confidence inspired hope in others.

Before the first decade of this century closed there were steamboats plying on the Hudson, and their success brought new confidence to those who hoped to see the empty inland regions supplied with the means of transportation, that would encourage settlers to establish homes in the wilderness which constituted the greater portion of the United States territory. There was, therefore, little proselytying to do in favor of railroad construction.

When the era of railroad construction began, the aim at first was to connect industrial centers, or to connect inland waterways with those of the seaboard. The joining of the leading cities by rail made the most rapid progress, and this had not been done to a great extent when the demand for high-speed trains arose.

The average American has always been in a hurry. He wants to do two days' work between each rising and setting of the sun. Any ordeal that keeps him idle or inert is particularly galling. No matter what improvements in the acceleration of transportation might be made, the mind of the traveler anticipates them. The canal boat was an improvement on walking, but the passenger was watching early and late, to see that the towing mules received due inspiration from the driver's whip to make the best possible time. When the steamboat pushed canal travel to the rear, the American traveler was ready to see his hogs thrown into the furnace if it would add a few revolutions to the propelling-wheel. When railroads began to make better time than any other method of transportation, the busy man soon got to consider it intolerable that he should be kept one hour in a train when the run might have been made in fifty minutes.

The American locomotive, which was worked out on native lines, and would not have been greatly retarded in development had no railways been constructed in other countries, went through a remarkably brief period of evolution. Many people, all over the world, believe that the locomotive was invented and perfected by George Stephenson, and that the machine emerged from his hand a perfect engine. That is not true even regarding Great Britain. During the first decade after the opening of the Liverpool & Manchester Railway, a host of inventors labored to design a better locomotive than Stephenson had built, and many curious mistakes were made.

A story is told of Napier, a famous Scotch engineer, who had been invited to witness a test of a locomotive designed by an ingenious individual shortly after the "Rocket" had won its first triumph. The inventor wished to interest capitalists in his engine, and tried to obtain Napier's endorsement. He succeeded in bringing Napier into the presence of the capitalists, but when the attempt was made to have the engineer testify in favor of the engine, nothing was forthcoming but a succession of protesting grunts. Losing patience, the inventor exclaimed, "Well, you must admit that you saw the engine running." "You may call that running," was the reply; "all I saw was you fellows shovin' her."

We had the "shovin' " period in America, but it did not last long. Colonel Long, one of the most eminent pioneer civil engineers, designed a locomotive for the Baltimore & Ohio Railroad when competitive designs were still in order. In a speech made years afterwards, he admitted that his locomotive was not a success. "On the trial trip," he remarked, "it took seven hours to run four miles, and we were moving all the time."

This was our early evolution period, and it brought forth some engines that were fearfully and wonderfully made; but they served a useful purpose, since their designs stood forth as dreadful examples of what not to do.

The first form of successful locomotive consisted of a strong rectangular frame which carried the boilers and cylinders, and had fittings to keep the axles of two pairs of wheels in a parallel position. Although a crude machine, weighing little more than a modern fire-engine, it possessed all the essential elements of a modern locomotive. It was light, but the permanent way of our early railroads was relatively lighter. On this account, the first radical change in the pioneer locomotive was made. The purpose of the improvement was, to distribute the weight of the engine over a longer base, which was done by carrying the front end of the locomotive on a four-wheel truck, or "bogie," as it is called in Europe, and the back end upon the driving wheels. A single pair of driving wheels was for a short time popular; but experience soon demonstrated that two pairs coupled gave superior service. That constitutes what is now called the "American" locomotive, which is the representative type on this continent, and far outnumbers all other forms combined.

For the first twenty years of railway history, the train speed was very moderate, but at the end of that time an agitation arose for trains to be run at the ambitious speed of a mile a minute. The men in charge of the motive power of several railroads were ordered to build locomotives that would maintain this speed, and a variety of engines, with single drivers about 7 feet in diameter, were put into service. They could attain the required speed with a light train, where a long run could be made without checking speed; but that condition existed on very few railroads, and the big-wheeled engines soon fell into disrepute. They were too slow in making the numerous starts required.

Besides, the time for a mile-a-minute speed had not arrived. For the first fifty years of American railroad history, there were scarcely any stations or junctions protected by fixed signals. There were no continuous train brakes in use, and for a considerable part of that period there was no reliable system for regulating the movements of trains on the single track, which was almost universal. "Running by the smoke or headlight" was a common practice. By that practice, the safety of the train depended on the care and vigilance of the engineer, who avoided collisions by watching in daytime for the smoke of engines coming in the other direction, and at night kept a keen watch for the glare of an approaching headlight. The locomotive engineers, as our engine drivers are called, became wonderfully skilful in avoiding accidents, in early days of crude practices and appliances, and their successors are equally efficient under changed circumstances. The numerous responsibilities, the sudden calls to meet emergencies coolly and courageously, develop all the higher attributes of manhood. Under whatever name you find the men who run locomotives, they are reliable and trustworthy; no matter in what clime or country they may be met, close acquaintance will prove them, as a class, to be more manly and self-reliant than any other portion of the population.

The general application of the Westinghouse air brake to our passenger equipment prepared the way for our modern express trains. This began in 1873, and the merits of the invention were so quickly appreciated that the only restraint to its introduction was the limit of manufacturing facilities.

The traveling public understand that the Westinghouse air brake has promoted the safety of railway travel; but it requires the man who has run locomotives with defective means of stopping to fully realize the value of a good continuous brake. When running at high speed in the ante-brake days, I used to feel that the driver was like the man who pulled the trigger of a rifle to send the ball into space. He could start it into speed, but he must wait for air friction, or the hitting of some object, to stop it.

This helplessness of the driver was painfully impressed upon me many years ago. I was fireman of the engine pulling a heavy excursion train, going from Montrose to Aberdeen. On the line there is a steep descending grade, five or six miles long, which ends at Stonehaven. We had about twenty carriages, packed as close as possible with passengers. The day was "muggy," and the rails were slippery. We had about two brakes to hold the train, and they were not sufficient. We had not run two miles on the incline when we lost all control of the train. It had run away from us. With the certainty of a clear line, this would not matter much; but we remembered that we were close on the time of a local train, which came out from Aberdeen and turned at Stonehaven, using the down main line for the engine to get from one end of the train to the other. Long before we came in sight of the signals, the whistle was kept blowing; when it came into view, the distance signal was at danger, and I thought we were running 100 miles an hour, and began looking for a soft place to jump. Just then the home signal was lowered to "line clear," and we let off the brakes and kept going. I have often wondered how many people who are still alive would have been in their graves more than thirty years ago, had that local train not been five minutes late.

A first-class locomotive does not differ very much when found in England, the Continent of Europe, in India, or in America; but the special claim made in favor of American locomotives is that they are less complicated than anything to be found elsewhere. Then men who have been most influential in designing our motive power have nearly all run locomotives in their time, and they thoroughly appreciate the advantages of simplicity of parts, and providing every convenience for the men operating the machines. On all our modern locomotives, the engineer can reach every appliance used in operating the engine without moving from his seat or turning round. With this convenience, he need never divert his attention from watching for signals. This is strongly in contrast with many locomotives to be found in foreign countries. English locomotives are much more convenient than they used to be, but they do not compare favorably with American engines in this respect.

A story is told about a Fairlie English double-ended locomotive that was put into service on the Denver & Rio Grande of Colorado in the early days of that road. The engine was very complicated, and American engineers objected to running it. An English engine-driver happened along looking for a job, and he was given the Fairlie to run as a helper on a hill. That man made a mistake that called for ten days' suspension, and an extra engineer was sent to take his place. The English engineer explained to his "locum-tenens" all about the peculiarities of the engine, the levers that had to be pulled to make it go in the desired direction, the places that had to be oiled, and the rockers, bell cranks and attachments that had to be kept in working order. When the "locum-tenens" had listened to all the directions about working the engine, he remarked: "Now, friend, you go right on running this engine and I'll take the ten days."—Extract from article by Angus Sinclair in "Pall Mall Magazine" for September.

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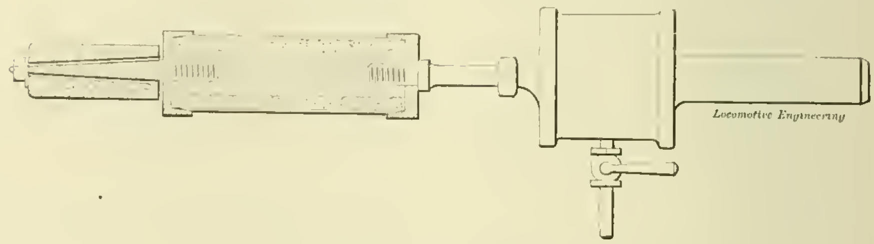
It is a gratifying sign of progress to see some effort made to tear away from the antique style of turning engines on a turntable that is made to have a sloth-like movement through straining human muscles on a wooden lever. Compressed air is better for the purpose, because it is cheaper.

Compressed-Air Polishing Device.

The familiar little air motor may perhaps be justly charged with an insatiable appetite for air, which must be supplied before it can be made to yield up the possibilities within it, but in its capacity of a grinder or polisher on certain work, this objection can hardly hold.

Our illustration of the motor rigged up as a polisher for casehardened links, furnishes an instance in point. Those of us who have tried to get a polish on the surface of a link just out of the casehardening box can understand something of the muscular effort required to either support the link on a wheel, or to get back to first principles and work the surface down by hand with emery cloth, as is still the vogue in many shops to-day.

This device consists of a cylinder 2½ inches in diameter with the usual winged piston, and also the usual eccentricity of piston and cylinder axes. The piston is extended to a piece of round iron into which it is tapped, and on the outside of which is placed a piece of rubber hose. The emery cloth is wrapped around the hose, and both are fastened in position by means of caps at the ends. One handle is cast on the cylinder-head, and the other is of wood, bored to a loose fit on the spindle at the opposite end. With a hand on each grip it is an easy matter to guide the rig over any shaped surface.



COMPRESSED-AIR POLISHING DEVICE.

The polisher is counterbalanced and suspended on a small chain so as to run the full length of the vise bench, where it is in constant use, either on links, rod straps or keys, in all of which situations it is equally effective. While this scheme may be worked in other shops than those at Huntington, W. Va., where our attention was called to its value as arranged by Master Mechanic A. F. Stewart, there are too many shops where the device is unknown, and those are the ones we are after. It is a good thing.

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A device for transferring any design on stained or painted surfaces, like wood graining, etc., has been patented recently. It consists of a thin sheet of rubber, on which are raised figures of the design to be reproduced. This sheet containing the design is wrapped about another piece of rubber which forms a soft and yielding body; the two sheets forming a cylinder which is rolled on the surface on which it is desired to reproduce a design.

Practical Letters from Practical Men.

Setting Valves by Sound.

Editors:

While the practice of adjusting the valves of locomotives by "sounding" is one not to be commended for accurate results, it is nevertheless expedient at times to locate faults and remedy them in this manner.

A competent engineer should be in charge of the engine, and the lubricator supplying oil in sufficient quantity to overcome the excessive friction caused by dry seats. Any excess of water in boiler above the usual amount must be worked off, and the normal conditions under which the engine does its work should be attained.

If the lameness is caused by wear of the motion parts and not by slipped rods, which can be ascertained by examination, the reverse lever should be hooked up near the center and brake put on to make the exhausts sound loud and distinct. An engine with balanced valves under these circumstances will almost invariably give a heavy sound at the back centers, or just before the cross-head reaches the back end of the stroke.

If a heavy exhaust comes at the back centers on both sides, which will be the case if both sides have worn alike, shorten all the eccentric rods an amount that will depend on the conditions found. Generally one-sixteenth of an inch is sufficient to make a lame engine sound fair, but the sharp exhaust of a locomotive fresh from the shop cannot be attained.

In case that an eccentric rod has slipped, replace it as near the original position as possible and work engine in the corner in the direction indicated by rod slipped as forward for forward motion rod. If heavy exhaust comes on front center, lengthen that rod until the exhaust sounds of the same volume as the others. Should the beats come at equal intervals but one side be louder than the other, examine the exhaust pipe, and, if a double nozzle, see that the holes are of equal area, also see if the lost motion is not greatest on that side. One of the worst faults of cast iron links is that one side is likely to wear more than the other, causing that cylinder to carry steam farther and thereby giving out a louder sound. The end of the tumbling shaft on the heavy side can be raised a small amount by liners, and in a measure overcome the fault, but it distorts to a certain extent the other functions, and should never be resorted to when it is posssible to take up lost motion of parts. Working cylinders, loose under-bars or defective frames will cause bad steam distribution and should be remedied before any attempt is made at adjustment.

FRED E. ROGERS.

Corning, N. Y.

Improvements on the Northern Pacific.

Editors:

The Northern Pacific is undergoing a radical change in the machinery department. Numbers of all engines have been changed and heavier class of engines changed to divisions where heavy power is needed, lighter engines vice versa. A new coal book was issued this spring, each book being composed of ton tickets, each ticket being numbered from 0 upwards, and in different colors for the different services. An engineer can tell at any time by looking at lowest number remaining on book just how many tons he has burned. All oils instead of being charged to engine, as formerly, are charged to engineer directly; each engineer having his own cans and removing same at completion of trip.

Engines are making (on this division at least) better mileage on coal than ever before. Master Mechanic Clarkson has made several improvements in front-ends, stacks, etc., that seem to have the desired effect, and performance sheets are looking better. Master mechanics of the system meet monthly and compare notes on how work is done on their respective divisions, cost of same, etc., and naturally vie with each other to see who can do best, and cheapest work, and they also ascertain which is the best way of doing work. Roundhouse foremen have to copy all work reported on work book by engineers. (Master mechanics can't read our writing.) This book is taken by each master mechanic to monthly meeting place and notes compared, expense figured, etc.

The new compounds working on this division—four mastodons and one hog—are doing good work, the Vauclain being slightly in advance of the Schenectady, in point of fuel economy. So far I have not been "mixed" up with the new compound ten-wheelers, but we hear they are fine steamers and light on coal. We note an improvement on the ten wheeler that would be desirable on the mastodon, the boiler heads are lagged and jacketed. The 200 pounds of steam carried by these new engines is great for developing horsepower, but "they do be harrud on valve ile." Will try and send some performance sheets shortly.

L. D. SHAFFNER.

Missoula, Mont.

A Curious Old Ten-Wheeler.

Editors:

I herewith send you a photograph taken at Phillipsburg, N. J., of an old Lehigh Valley Railroad engine (No. 158) having ten wheels, the main driver being in front. If you know anybody who could give me a little history of it, kindly let me know.

A CURIOUS OLD TEN-WHEELER.

FOSTER BIRD.

Philadelphia, Pa.

The Lubricator Question.

Editors:

I have been a constant reader of "Locomotive Engineering" since August, 1888, and in all that time I have not had occasion to take exception to any of your writing on locomotive matters until I received my August number, in which I noticed the answer (No. 55) to a communication from G. H. M., of Hewins, Kan., relating to an argument he had with a young engineer regarding the working principle of the sight feed lubricator, and referred to you for judgment which to my great surprise was favorable to G. H. M.

Now my experience with lubricators, in which I have some fifteen of different types under my care, leads me to believe that the young engineer was quite right in his theory and should have received the credit if any was due. By a little experiment G. H. M. will be able to see the error of his assumption. Let him, if he is in charge of a locomotive, block his engine on the rails, open the throttle wide, and place the reverse lever in the center of the sector. This will give him full boiler pressure in the steam chest, and will equalize pressure on the lubricator; then starting the lubricator I think he will find that it will work and continue to work until the oil is exhausted.

In stationary engineering all lubricators are placed above the throttle valve, and the fact that they will feed when the throttle is closed, with equalized pressure on the lubricator, is enough to convince me that G. H. M.'s theory is far from being correct. Before writing you on this matter, I examined several lubricators on locomotives running into this city and found they are not different from those under my charge, and the men in charge of them have no trouble whatever in getting the oil to the cylinders without any attachments other than the steam connections and oil delivery pipes. Hoping that I may hear from you and others on this subject through "Locomotive Engineering." I remain, yours truly,

J. E. Conley.

Nebraska City, Neb.

[The theory of lubricator action is based on equalization of pressures in the steam and oil delivery pipes, but it is well known among locomotive men that there must be an unbalanced pressure to insure proper action on a locomotive, or, in other words, the pressure on the steam pipe must be greater than from the steam chest in the delivery pipe. Experiment has shown that on locomotives the oil will cease flowing from the lubricator long before the pressure in the steam chest reaches boiler pressure, showing in that case that while boiler pressure was on the condenser side of the lubricator, a less pressure on the delivery side was sufficient to stop the flow of oil; the failure to feed was found in every case to be due to the cause named, which was evidence enough that the pressure must preponderate on the condenser side before the lubricator would feed, and this made the instrument a useless adjunct when the throttle was wide open.

Without going into the reasons for this performance we give the facts as they stand, and add that there is much attention given this question at the present time on different roads, made necessary by the intermittent action of lubricators, which is responsible for the ejector device to assist the flow of oil, as mentioned in the August issue. Our correspondent is referred to the proceedings of the Western Railway Club for April, 1897, where he will find interesting data on the lubricator subject which may convince him that the locomotive cylinder lubricator does not lubricate on purely theoretical lines.—Ed.]

Changing Lead.

Editors:

When necessary to change the lead of a modern locomotive it is a matter of considerable trouble as all eccentrics are supposed to be keyed on the axle, and if the cut and try method is followed it necessitates the removal of the eccentrics from the keys in order to get them out of the axle and then the replacing of the eccentrics and straps and the coupling of blades to the links. Then follows the exasperating experience of the fellow in the pit endeavoring to move an eccentric a thirty-second of an inch, and not have it draw back in the old set screw marks. Anyone who has been in such a non-get-at-able and trying place can appreciate the following method of getting the amount of offset to be given the keys without the laborious way described and without the errors caused by lost motion.

In Fig. 1 we have a diagram of a valve, rocker, strap and eccentric. Assuming that the valves of this engine have ⅞-inch lap and it is desired to reduce it to ¾-inch, it is necessary to reduce the linear advance an amount corresponding to the reduction of lap, planed from steam edge of the valves, or ⅛ inch. The upper rocker is 12 inches long and the lower one 11 inches long from center to center, throw of eccentric 5¼ inches, diameter of axle 8 inches. Now if the valve is moved ⅛ of an inch the center of the lower rocker pin will be moved $\frac{11}{12}$ of this amount. Following on to the eccentric we find that the point *F*, which is the center of the eccentric will be moved this same amount, viz., $\frac{11}{12}$ of ⅛ inch ; but we want the offset to give the key and this lies in the surface of the axle outside of the travel line of the eccentric center.

Diameter of axle being 8 inches, radius equals 4 inches; throw of eccentric being 5¼ inches, radius of eccentric path equals 2⅝ inches.

So the offset will be multiplied by the ratio of $\frac{4}{2\frac{5}{8}}$, or $\frac{32}{21}$.

Therefore we have $\frac{1}{8} \times \frac{11}{12} \times \frac{32}{21} = \frac{11}{63}$, or practically $\frac{11}{64}$ inch offset.

For convenience the diameter of the axle and the throw of the eccentric can be used instead of their radii, which gives us the following simple formula:

$$O = \frac{A\ L\ D}{U\ T}$$

in which

O = Amount of offset.
A = Amount valve is to be moved.
L = Length lower rocker arm.
D = Diameter of the axle.
U = Length upper rocker arm.
T = Throw of eccentric.

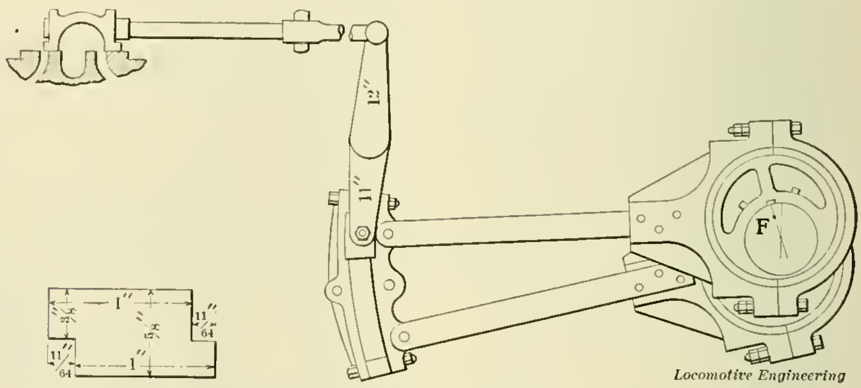


Fig. 2 Fig. 1

CHANGING LEAD.

The offset key when planed will be as shown in Fig. 2, and when correctly set in the axle should be plainly marked so that no mistake can occur by getting it reversed at some future time.

Fred E. Rogers.

Corning, N. Y.

Steeled Iron for Locomotives.

Editors:

I write you the results of some experiments with steeled iron which we made in an effort to get a back cylinder head that would not break with such persistent frequency as ours had been breaking on our 22 x 26-inch cylinders with Laird guides. We have 20 of this class of engines, and have had a great many broken heads. One engine in particular had five heads put on in six weeks. We had strengthened the head and braced the guide yoke to boiler, but still they broke until the new head was put on and in three months none of them have broke as yet. The process has been used before, but it is the opinion of the writer that it is not universally known or used, and at the same time might be used by other roads and for other castings than cylinder heads where a tough casting and a certain amount of deflection is required.

We tried in the first place to melt chips from Bessemer rails in the ladle, but found that unless the chips were very fine and iron very hot they would not melt. So now we plane up some scrap rails, take the chips and put them in the mold made in open sand so as to make the pig 7½ per cent. steel. These are run off a few at a time at each heat and piled up for use when making cylinder heads. These pigs are melted and run into heads and the steel is thoroughly mixed with the iron.

For testing the material we cast four bars 4 feet long and 1 inch square, two of common cast iron and two of the steeled iron; these were laid first, the two common iron bars on supports at either end 44 inches between supports and 12 inches apart, and pig iron carefully laid on until they broke, and deflection measured. In the first case the common iron broke at 1,045 pounds, and the deflection was 15-16 of an inch.

In the second test, that of the steeled iron, all conditions the same, it broke at 1,859 pounds, and the deflection was 1 15-16 inches. It so happened that the Association of Mining Engineers were making a tour of our shops and road on that day and the tests were witnessed by a number of the members.

There is no appreciable difference in the turning or drilling of the heads, and but little difference in the looks of the metal when broken.

When polished the steeled iron takes on a better finish than the common iron.

Of course 18 and 19-inch cylinder engines do not break as many back heads as those from 19 inches up, and those using the larger cylinders and Laird guides will probably appreciate the necessity for an improvement in their castings.

D. P. Kellogg.
Asst. Gen. Foreman D. & I. R. R. R.
Two Harbors, Minn.

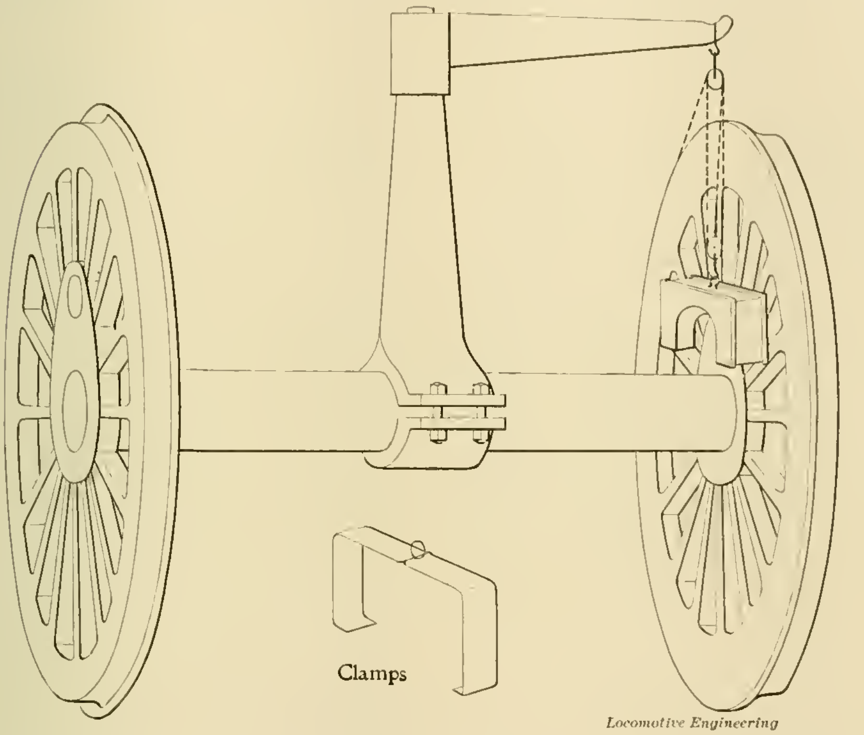
Handling Driving Boxes.

Editors:

I was recently in the Northern Central shops at Elmira and saw a rig in use for handling driving boxes which gave me a backache when I thought of the times I had lifted driving boxes by hand.

The sketch shows the idea fairly well. There is an upright clamped midway of the axle as shown, and this carries an arm which swings on it. A light chain hoist is on the arm and a pair of clamps (shown below the axle) hold the box without the necessity of an eyebolt in it, as many use. This is cheap, easily handled and saves lots of "back-achy" work on the part of the fitters.

I. B. Rich.
Camden, N. J.



HANDLING DRIVING BOXES.

Not Flying Yet.

The Pikes Peak railway is still doing business at the old stand, and the alleged flyer, William B. Felts, who has been "going to" fly from the summit has left for parts unknown. Probably his nerve failed to keep up the necessary high pressure and he thought it best to light out before the crowds who had come to see the "fly" made things warm for him. He left his machine, however, and the railway will probably make more money taking people up to see that.

How to Make Light Repairs on the Locomotive Boiler.

BY HENRY J. RAPS.

The boiler has arrived at that stage when it is necessary to remove all of the tubes, if they are close together, say, ½ inch to ⅝ inch, this will be from two and a half to three years after engine was put in service; should they be ⅞ inch to 1 inch apart, it will be three and a half to four years, provided that the boiler is using the ordinary run of water. Should the feed-water be such that considerable scale is formed of a hard, stony nature—impervious to water—the life of the tubes between settings will be shortened from six to eight months.

Rainy seasons also shorten the life of tubes between settings, especially in boilers in which scale has formed to a considerable extent.

The soft water loosens the scale which has formed on the tubes and it is lodged between the tubes; at every successive rain more scale is loosened and lodges between the tubes, until finally all the space is filled up, making the removal of tubes necessary.

The usual method of making repairs at this time is to remove tubes, make a cursory examination of the external portion of the shell—if lagging is removed—and caulk all leaks. If any staybolts are broken they are renewed, a few rivets taken out of mud-ring and replaced with new ones, and seams in firebox caulked where necessary.

If stay-bolts and radial-stays or crown-bar rivets are not leaking (they should not be if boiler has received proper care), no attention is paid to them. The mud and loose scale is thrown out of the boiler, it is given a rinsing, the tubes are replaced, and the boiler is "just as good as new" and ready for service.

This is by no means an exceptional way of making repairs.

When a boiler needs no other repairs than the changing of tubes the greatest amount of labor should be put on the inner part of the boiler. You will want your best man to do it, not necessarily the best mechanic, but a man with patience, endurance and perseverance, plenty of stick is what is needed. Furnish him with all kinds of cleaning rods, a scaling pick, hammer and chisel, a few torches made of ⅛-inch steel wire, wrapped at one end with asbestos, and a can of oil to replenish torch; can should have neck large enough to allow the insertion of torch. Have all the scale cleaned from sides of water-leg, staybolts, crown-sheet, crown-bar washers, crown-bars and shell. Do not expect to have the labor performed in a few hours; it will take five or six days to do it properly. When the scale has been loosened, the boiler should be thoroughly washed; this cannot be done properly in an hour or two, but will take six or eight.

As all parts of a locomotive boiler are

not open to inspection it is impossible to keep all parts cleaned alike; you may find here and there the water space nearly filled with scale, and, although it has made no trouble, the trouble was not far off.

The cleaning process should be begun at the lowest part of water-space and continued toward the top. Especial pains should be taken with the inner end of stay-bolts, inner side of water-leg, crown sheet and crown-bar washers, as these are the parts that make trouble on account of scale formation. The bottom of shell should also be cleaned thoroughly its whole length and about 30 inches wide in order to ascertain its condition in regard to pitting and grooving. As a rule, the shell will be pitted most just below the checks; the pits are not readily discovered, and must be cleaned out with a chisel. If guide-yoke or frame-brace angles are fastened to shell with either rivets, studs or tap-bolts the pitting is invariably worse around these than elsewhere. The pitting and grooving of shell should not be dangerous at this time.

All braces, brace-pins, brace-lugs, crows feet and angles should be thoroughly inspected. If the boiler is sufficiently braced, these should still be in good condition. However, this should not be taken for granted, as the safety of life, limb and property depend as much on good sound braces as on sound staybolts.

It may be that the brace-lugs and crows-feet instead of being forged from the solid bar, are made of two pieces jumped together, and that some of these are pulling apart in the weld. They should be removed and replaced with braces forged from the solid bar. Should back tube-sheet have crow-foot braces riveted solid to tube-sheet, they should be taken off, holes in pad or flat end welded up, a piece of 1-inch pipe 1 inch long put between brace and tube-sheet, new holes drilled in pad and braces reriveted. This manner of bracing allows the water to circulate between brace and tube-sheet, keeping the sheet cool and preventing cracking and distortion around the rivet-holes.

Should the long tie-rods extending from back-head to front tube-sheet or to lugs riveted to shell pass under the crown bars, they will likely be found sagged down on crown sheet. These should be tied up with ⅝-inch hook-bolts and straps laid across upper braces.

A bad form of bracing followed by some is to put crows-feet on either side of wagon-top opposite crown bars and running braces across with jaw at either end, fastened with pin and cotter. It is almost impossible to remove these braces when broken or to replace broken pins without removing crown bars. On account of their bulk at the crows-feet they also accumulate considerable scale and prevent loose scale from dropping through into the water-leg where it can be washed out.

A better plan of bracing is to put in tie-rods, tapped into both sides of wagon-top and hammered over. The lower side of tie-rods should be on line with lower side of crown bars in order to make all the room possible for washing of crown.

The wagon-top should be so strong that it will need a rod through only one-half of the spaces between crown-bars, leaving every other space clear for the removal of scale and washing and inspection of crown. Should more than this number of rods be required another row should be put in above these.

Should crown be radial-stayed it is probable that the upper seam of tube-sheet has become distorted on account of the rigidity of the stays. Further distortion may be prevented by removing the two front rows of stays, inserting eye-bolts in both upper and lower sheets and fastening a flat bar of iron on either side of them with pins and cotter. They should be fastened together in the center with a ⅝-inch bolt, a washer the same thickness as eye-bolts being inserted between them; the upper holes in braces should be slotted lengthwise ¼ inch longer than diameter of pins to allow the tube-sheet to expand, as in firing-up the front part of box expands more than balance of box or outer sheets of water-leg causing distortion of the tube-sheet if no allowance has been made for it. The upper flange will crack sooner or later on account of the bending action. The cracks may be drilled out and plugged or cut out and a patch put on, but the final outcome is usually the removal of tube-sheet.

It may be that we are too presumptuous in assuming that the firebox needs no other repairs at this time than the removal of scale from its outer parts. It may be that cracks have developed at some of the staybolt holes on account of scale accumulation, or rather on account of carelessness in not removing the scale. If the cracks are not too numerous—not more than six or eight in one sheet, and not more than one crack at a staybolt nor more than 1 inch in length—they may be drilled out and plugged successfully, should the general condition of the sheet warrant it.

The staybolt should first be removed, the first hole should be drilled next to the staybolt hole; ⅛ inch (or less, if it can be done successfully) of metal should be left between the holes. The hole should be tapped with a 14-thread taper tap; an iron plug inserted and screwed in tight, then marked with a chisel where it is to be cut off, allowing 1½ to 2 threads for hammering over. It is then removed and nicked with a hack-saw on two opposite sides, leaving stock enough to screw plug in steam tight. Should plug project through sheet more than 1½ threads the end should be sawed off. The plug is again inserted and twisted off. Should a second plug be necessary to take out balance of crack, the drill should be set so that it will cut into the first plug as far as the root of thread. The same process is gone through with as with the first plug. They are then held on, on the inside, with sledge, and hammered from the outside with a round-ended steel pin through staybolt hole and finished by holding on through staybolt hole and hammering from inside. The staybolt hole is then tapped out, staybolt put in and hammered.

There are those who will say that it is not necessary to describe the drilling out and plugging of cracks in firebox sheets, as it is a very common practice. Very true; but practiced, usually, as a make-shift to keep an engine running until she can be brought in for repairs. Very little attention is usually paid to the length of plugs; they are allowed to project into the water-space and accumulate scale which in time makes it impossible to keep plug tight. Iron plugs put in as described in a sheet not entirely worn out, will give as good or better service than a patch.

If the sheet has been badly mud-burnt, and is seamed or cracked between several of the staybolts in one locality, the affected part should be cut out and a patch put on. The method usually followed is, to cut out the affected part with a cape chisel and ripper. A cut ⅛ inch deep is taken with the cape chisel, and the balance of the metal is cut out with the ripper, whose face should be ¾ x 3-16 inch. The staybolts are drilled on the outside, a punch inserted in the hole, and the bolts broken. The patch is then marked off by placing the old upon the new and drawing a line upon the new piece 1 1-16 inches from the edge of the old, for the seam.

Allowing 5-16 inch for the thickness of chisel, this makes the lap on old sheet ¾ inch from the center of holes. The holes should be spaced 1¾ inches apart, *C* to *C*, and punched ¾ inch. The patch should then be trimmed on the outside, allowing ⅞ inch from center of holes for lap. It is then annealed, bolted to firebox sheet through staybolt holes; holes in seam drill 25-32 inch and tapped ⅞ inch, 12 thread, with taper tap. Holes in patch are then reamed 20-32 inch and countersunk to an angle of 45 degrees; the bulk of the metal being cut out with a drill and finished with a rose-bit. All burrs and oil are removed; holes in sheet are tapped with straight tap, and patch put on with patch bolts, which should not be over ⅞ inch long. When the bolts are screwed in up to head, the patch should be hammered up around the bolts with punch and hammer, the bolts again screwed in, and the process repeated until all parts of the seam are brought in contact. The bolts should then be nicked with a chisel under the square head and twisted off; the staybolt holes tapped; bolts put in and hammered over; the patch bolts fullered and caulked, and the patch chipped and caulked, finishing the operation.

Should the patch extend down to mud-ring, it may be put on with rivets by bending the patch up at the bottom far enough to admit a wedge-bar for the purpose of holding on the rivets.

Patches may also be put on with tapered plugs. The process is punch holes in patch, bolt it to sheet and drill the holes, then taking off patch and removing burrs and oil, patch is again bolted on, hammered up at one of the holes, hole tapped out with a taper tap, a steel tap bolt put in which has the thread cut off from upper part of body a little farther from head than the thickness of patch so that it will pull patch up to sheet. The patch is then hammered at the hole on either side of bolt, the holes are tapped, plugs inserted, nicked and twisted off, and the process repeated until all the plugs are put in. They are then fullered and caulked. In tapping just enough oil should be used to prevent stripping the thread. Should the patch extend down to mud ring, it should be bent up at the bottom (provided the patch is large enough to warrant it), and plugs held on with a wedge-bar and hammered as they are put in.

When the patch is to be bent back to place, enough thin washers should be put in water space at the lower staybolt holes to make up for width of space, to prevent the patch from buckling into water space while being bent back to place. The practice in some shops is to offset patches next to seam from ½ inch to 1 inch to stiffen the seam and prevent leakage; another practice is to insert copper between the seams for the same purpose.

The latter usually results in grooving of sheet next to seam.

Should the crown be warped on account of scale deposit, it should be heated and straightened before the crown-bar rivets are removed. If a patch is necessary it should be put on top of sheet and riveted.

In putting on bolt patches it is very important that all chips and grit be removed from seam, holes and bolts, that threads are full, that the lap is not too wide, that the body and head of bolt fit properly, and all other details are just as important and should be given the closest attention, for upon the details depends the success or failure of the whole. A patch that is not a success when put on will always be a failure and a source of annoyance.

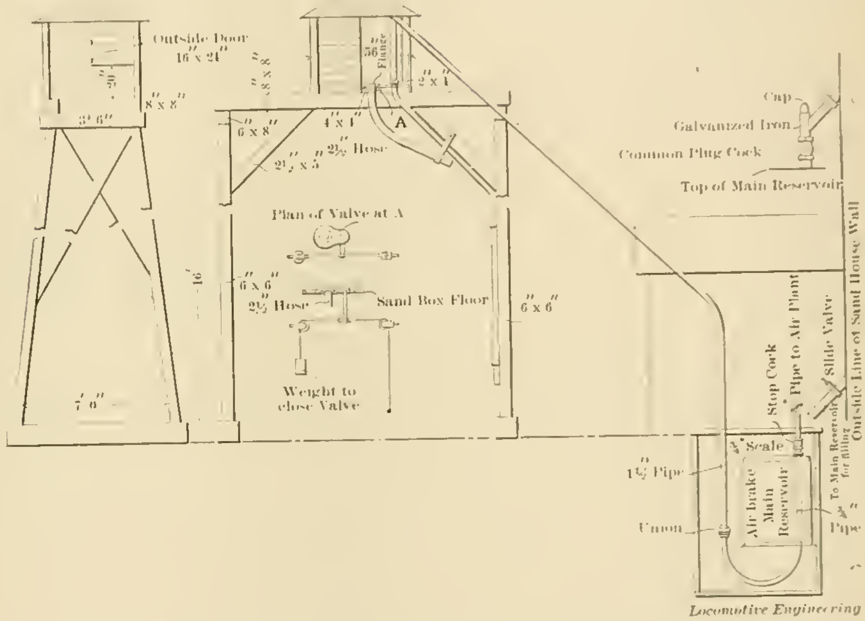
When the necessary repairs have been made on the firebox and internal portion of the boiler, the copper thimbles should be expanded in tube sheet and tubes replaced. The back end of tubes should be made large enough to require three or four smart blows from a 6 to 7-pound hammer to drive them in. The front end of tubes should be enlarged so that shimming will be unnecessary.

Assuming that the workmanship has been of the best, there is still one more requisite necessary to make the repairs successful, and that is proper care. Without it the best construction and workmanship is of no avail.

Sanding Appliances on the Michigan Central.

At the Jackson shops of the Michigan Central Railroad, Master Mechanic Hennessy has a system of sanding engines as shown in the illustration. It comprises a covered storage box of about 50 cubic feet capacity, which is supported on a wooden frame work, and placed centrally between the rails at a hight to clear the highest stacks.

The sand supply is furnished to the elevated box by means of compressed air, which forces the dry sand from a tank set below the ground line (made of an old main air reservoir), just outside of the sandhouse; the reservoir being filled with sand for elevating by means of the valve shown in detail, which has connection with the supply in the sandhouse. This valve, and also the valve for controlling the air admission, is in a convenient position for handling, in the small house erected over the reservoir.



SANDING APPLIANCE ON THE MICHIGAN CENTRAL.

A 1½-inch pipe extends from the bottom of the latter to the top of the elevated sandbox, and conveys the sand to same when air is admitted to the reservoir.

Sand is taken by the engine through a section of hose depending from the bottom of the elevated box to the sandbox of the engine, the admission of the sand being regulated by a valve at the receiving end of the hose, as shown in detail. The rig is located near the water tank with the purpose in view of taking water and sand at the same time.

The Gold electric car heaters are meeting with much success on street railway lines, and as some of the leading railroads are adopting electricity on their branches or "feeders," this is of interest to them. If they are as successful as the steam heating apparatus of this company, there is no doubt as to their popularity.

Results in Small Savings.

A measure of economy is successfully practiced at the Chicago shops of the Chicago & Northwestern Railway by simply reclaiming the brass that finds its way to the foundry floor and into the furnace. These particles are small individually, but collectively they yield up enough revenue to pay for the labor and leave a favorable impression on the earnings columns in the office records.

The coal after use in the furnaces, hitherto thought only fit for the cinder dump, is passed through a screen, leaving a coke of fairly good quality, which is used to fire the blacksmith shop boilers. This, while a saving, is, however, only a preliminary to the brass saving process. The coal that passes through the screen is next placed in a revolving cast iron cylinder about 48 inches in diameter and 15 inches wide, having an opening in one side in which to introduce the fine particles of coal. The cylinder, whose functions are those of a crusher or pulverizer, is filled with water and coal up to the opening, after which one or two pieces of driving axle cut off to a length equal to the width of the cylinder are placed in the latter, which is made to revolve about 60 revolutions per minute. The rolling quickly triturates the contents.

A trough is conveniently near, into which the pulverized material is placed, and on which is directed a fine spray of water. All of the lighter particles float away, leaving the brass to fall to the bottom to be used again. By this cheap, but efficient arrangement, about 75 pounds of brass is saved per day. At 7 cents, this represents $5.45, against which must be put $1.50 for attendance if no coal is saved. In this case the cost of labor is met by the saving in coal, thus leaving a profit of $5.45 to show as the results of small savings.

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Brick Arches and Leaky Tubes.

We do not remember of any appliance used in train operating that has gone through such a varied reputation on the American continent as the brick arch used in the fire-boxes of locomotives. That was one of the devices first made use of to enable bituminous coal to be burned in locomotive fire-boxes without causing a smoke nuisance and it is almost the only one of the early smoke preventing appliances that has survived the shocks of prejudice and the tests of varied experience.

About 1857 Thomas Yarrow, locomotive superintendent of the Scottish North Eastern Railway, obtained a patent for a smoke consuming fire-box, the principal elements of which were a brick arch set diagonally across the fire-box from a point below the tubes, and a perforated iron plate set vertically in front of the grate bars to admit air above the fire. When first applied to locomotives in Arbroath, Scotland, it was a real arch, for it was built of common fire bricks and the arch form was necessary to keep it from falling. From the first day of its application the arch with careful firing was found to be an efficient preventative of smoke, and by its use the railway companies of Great Britain were able to change from the use of coke as fuel to bituminous coal with great reduction of expense in train operating.

About the time the brick arch was beginning to prove successful as a smoke preventing device Yarrow patented a water table and put it into several locomotives. That was not found to be so successful a smoke preventer as the brick arch and the original inventor soon abandoned its use, but it was reinvented and patented afterwards in various countries, the Jauriet water table extensively used on the Chicago, Burlington & Quincy having been almost the identical of Yarrow's invention.

The original purpose of the inventor of the brick arch was to give the flame and gases pasing from the fuel a longer journey in their way to the tubes in order that the oxygen might have longer time to make the necessary admixture for achieving complete combustion of the fuel. Incidentally it was found that the bricks constituting the arch acted as a reservoir of heat and that part of this heat was given out to the gases passing up below the igniting temperature. Owing to this action the arch acted as a heat regenerator and by that means effected considerable saving of fuel. The water table did not act in this way because its temperature was never higher than the temperature of the water, therefore, its only function was to prolong the journey of the combustion gases. That was why the water table was always a failure when compared to the brick arch, although there were several constructive points in its favor.

When it became necessary for American railway master mechanics to employ bituminous coal for fuel in locomotives, the nuisance of smoke raising very soon became a cause of complaint and legislators were not slow to impose pains and penalties. Under the spur of public opinion and of legislative enactments our master mechanics gradually turned their attention to methods of smoke prevention and they drew very freely upon the experience of their European compeers in this line of engineering. A variety of smoke preventing devices were introduced but none of them had real staying powers except the brick arch. The proceedings of the Railway Master Mechanics' Association furnish an excellent history of the ups and downs of the brick arch. Various committees reported on its merits and defects. By some men it was lauded as the best coal saving and smoke preventing device that ever had been applied to locomotives; by others it was declared an unmitigated nuisance, source of delay and originator of expense. Its popularity and evil reputation seemed to move in waves. One time it was on the crest then it was down in the depths.

We have listened to a great many discussions on the merits and vices of the brick arch, but never until we heard a discussion on the subject at the last meeting of the Traveling Engineers' Association did we perceive the real cause of the conflict of opinion respecting the value of the brick arch. All who took part in this discussion and had had experience with brick arches admitted that for deep fire-boxes the arch was a good thing until the tubes began to grow thin and had to be caulked frequently. All agreed that the brick arch saved about 20 per cent. of fuel when the boiler was in good order, but when leaky tubes began to be a common condition, putting in new arches cost more than the fuel saving amounted to. The consensus of opinion expressed by the supremely practical and extremely intelligent men constituting the Traveling Engineers' Association was that when the tubes began to leak habitually the brick arch should be removed and kept out of the fire-box until the tubes could be renewed.

There is matter for very serious reflection concerning this conclusion as to when the brick arch has passed the day of its usefulness in a particular fire-box. There are certain master mechanics who take a pride in forcing the engines under their charge to perform a certain mileage before they will consent to have tubes changed or light repairs done. We have always considered that one of the most expensive practices followed was to persist in keeping locomotives in service after the tubes had become so tender that leakage was chronic. When tubes are leaking very badly about half the fuel is wasted keeping the other half burning. The fact that a brick arch cannot be used economically after the tubes begin to leak is proof positive that instead of removing the arch the proper thing to do is to change the tubes. To the master mechanic, who follows a hard and fast rule as to the mileage an engine should make before the tubes can be removed, we commend a little figuring so that an estimate may be made of the cost of this particular policy. Those best able to judge say that a brick arch saves from 20 to 25 per cent. of the coal used by one having no arch. Suppose we call it 15 per cent. We know of roads where engines will be forced to run 20,000 miles after the tubes have become tender. Figure up the extra coal needed for that mileage or half of it and compare it with the expense of removing, safe ending and putting in a set of tubes. If the man who insists on the stereotyped mileage will do this, we feel certain that a new light will dawn upon him concerning the economical operating of locomotives.

It has become the fashion of late to hound the enginemen to perform superhuman efforts in making the engine do its work with less consumption of fuel. Railroad official opinion holds that the best way to keep down operating expenses is to impress upon enginemen the value and virtue of fuel saving. This sentiment has been carried beyond the line of utility. We are strongly of the opinion that officials might give enginemen a rest and look into the practices of the wrong-headed master mechanic who is striving to gain a reputation for long mileage between the shopping of locomotives. The recurring report that leaky tubes of a particular engine have caused loss of time will, to an understanding mind, convey the information that for want of timely repairs the engine is wasting a large part of the fuel thrown into the fire-box.

No matter whether a railroad company uses brick arches or not, a locomotive suffering from leaky tubes wastes a large proportion of the fuel in vaporizing the water injected into the fire-box—therefore don't tolerate leaky tubes.

Location of Engines and Shop Tools.

Among the many instances coming within our knowledge of separate engines to drive shop tools, our contention is confirmed, that the choice of power for the whole plant was rather the result of guess work, than a correct estimate of the needs of the tools. Bad work in such an important matter is too often accompanied by an entire failure to provide for steam at the place of consumption, since a central boiler plant is in such cases almost always designed to furnish the engines with steam, and some of them will suffer in consequence.

Steam taken from a boiler several hundred feet distant from the engine, and an engine purchased simply because it was supposed to be able to drive something, give as pretty conditions for wasting good money as can be conceived, but the case quickly assumes an alarming phase if low atmospheric temperatures prevail. Under these conditions an engine simply becomes transformed into a fiend with an insatiable appetite for steam. This status of things is often found in separate engines driving boiler shop or blacksmith shop tools, so far away from the steam supply that the engine is practically driven with hot water. The thermal units were put into that water at the boiler at the usual cost per unit, but they deserted in a body when made to do the menial duty of crawling through a long pipe, unprotected from the shivering blasts of winter weather.

One of the most flagrant cases of too much doctor in ordering and location of engines that ever came to our notice, was that on a trunk line, only a few years ago. These engines, two fine Corliss machines, were put in to suit the tools of the two shops they were to drive. The boilers were located so as to bring the battery in a central plant near one of the engines; steam was coaxed to the other engine through a long tunnel. The trials in store for that lone engine were not dreamed of when that tunnel reposed on paper in the drawing office, but they were not slow in asserting themselves, when steam was sent through it, and they continued in evidence to torment their authors long after the pipes were covered with expensive insulating material. The net results in the case may be summed up in an engine that could perform its duty only because another mistake had been made by getting an engine much too large for any demands for power that would ever be made on it, and that error was the sole reason why power was given off the band wheel, for if an engine had been bought to drive the plant with economy—which means a much smaller engine—the low steam pressure furnished through the tunnel would not have turned the line shaft. And so one blunder was made to cover another and worse one.

An instance of stopping the waste of steam by one of these engines known as a steam eater, is recalled as a recent occurrence, where a 30 horse-power engine was driving boiler shop tools on moisture furnished by a battery of boilers about 400 feet away. It was decided to take out this engine and drive its shafting from the main shaft in the machine shop by means of a rope drive. This was easily done, for the reason that the main engine was one of those overcylindered mistakes which was ordered for future extensions that were never developed. The rope drive was a correct solution of that difficulty, so correct, in fact that less coal was burned with the increased load on the engine than before the change was made.

With these facts before us, the conclusion is naturally drawn that posterity deserves something at the hands of those of us who design and locate shop plants, and this refers especially to the engines and boilers, and the location of tools, for anyone who has had to move a tool from an expensive foundation will agree with us that dollars were wasted in the operation if its original location was wrong; there is much of this kind of work done, either from want of experience or a desire to win fame on someone else's reputation. It seems to us the best course to pursue to deserve the good opinion of those of to-day as well as those who are to follow, is to build right. It will be found conducive to economy to send power to its destination through the strands of a rope, in considerable distances, rather than through condensation in a steam pipe, and by the same token an engine cannot be too near its boiler.

Engineering on the Chicago Great Western Railway.

The methods pursued to reach results in the machinery department of the Chicago Great Western Railway are interesting to anyone who strives to keep posted on the many ways of arriving at the common goal—economy in management. Originality and independence of thought are two pre-requisites of the greatest importance in devising schemes to meet certain conditions, and equipped with these, success is assured at once.

This is particularly true in the matter of the purchase of fuel, one of the largest items of expense in the operation of most railroads. On this road they go to the fountain-head, and purchase coal on its evaporative efficiency; the greatest number of pounds of water turned into steam at the required pressure, for each pound of coal consumed, is the measure of calorific value of the coal they purchase, and the fact that a fuel comes from any well-known district has no bearing in the case. Its acceptance or rejection is governed entirely by its ability to transfer its thermal units to the water. A boiler plant has been designed and installed for the express purpose of arriving at the value of samples of coal, and the practical test decides which fuel will be the best for their use.

An accurately arranged chart, showing the findings of the tests so far made, on which the evaporative efficiency and all particulars bearing on the heat value are entered, is kept for reference. One of the most notable and unexpected items of information to be gathered from these charts is, the widely differing value of coal coming from practically the same mines. This is one of the points that emphasizes the wisdom of coal testing on the grate, as against the readings of the calorimeter.

As is well known to those who have kept pace with the literature of the subject, this road was a pioneer in the tonnage rating of engines, in which the hauling capacity of the engines was made to accord with the actual and not the theoretical power; as, for example, two of the same class and size may have a different rating by the power shown in test; that is, the two engines will have a different tonnage assigned them by reason of one developing more or less tractive power than the other. The actual capacity of the engine is therefore used, which effectually puts an end to guesswork in assigning tonnage. In arriving at the hauling capacity, the theoretical tractive power was based on a mean effective pressure equal to 90 per cent. of the boiler pressure, and loads were then hung on, or set out, until the maximum power of the engine was determined on each division of the road. While this scheme for tonnage ratings has not been perfected in accordance with theory, it has been extraordinarily successful in demonstrating just what tonnage an engine was able to haul on any district of the road.

General Master Mechanic Lyon is the author of these practical steps looking to a creditable administration of affairs in his department, and while he is one of the youngest officers in a like position in this counry, he has put his training as a mechanical engineer to such use as to make plain his eminent fitness for a place at the top.

Designing and Building Railroad Shops.

Time is working many changes in the different branches of railroading, and many of the peculiar divisions of responsibility which were formerly in vogue are giving way to a more rational basis. One case in particular is the taking of the design and construction of railroad shops and roundhouses out of the hands of the department of Maintenance of Way and putting it where it always belonged, in charge of the Mechanical Department. Some of the shops in existence to-day bear evidence of the lack of appreciation or knowledge of the requirements of such shops. They are often entirely too low to admit traveling cranes, necessitating the use of small jib cranes or of handling heavy material by hand, either of which are not as economical as though traveling cranes could be employed, as their extensive use in large locomotive works testify.

Then the shops are very frequently arranged with more of an idea of beauty in the ground plan than for convenience or economy of getting out work, the departments which should adjoin each other being at opposite ends of the plant.

It is not intended to throw discredit on the Maintenance of Way Department; they were simply required to do work which was out of their line, and which can be done better by those who are to manage the shops after they are built. The same process has been going on in other lines, and the modern building, whether for mechanical or office purposes, is now more the work of the engineer than the architect. The engineer erects the building with its massive foundation and frame of steel, then the architect puts on the trimmings. Let the mechanical departments design and erect the shops and buildings they are to occupy, and have the other departments attend to the work directly in their line.

It is too often the case that railroad shops are not designed as carefully for an economical production as are manufacturing shops of a similar nature, and this is a point which can be looked after to advantage when new shops are to be built or old ones rearranged. While it is generally impossible to do work in a railroad shop as economically as in a locomotive works, owing to more varied work and the production of smaller quantities, attention should be paid to reducing the cost of the work as much as possible.

Oil as Fuel on the Southern Pacific Railway.

The Southern Pacific has, we understand, committed itself, as a purchaser and consumer, to California petroleum. Several engines are said to have been fitted up very recently to permanently use crude oil, and some 30,000 barrels bought by the corporation to inaugurate the change to the oleaginous heat-producer.

This is no new venture, unless it may be so with the road about to embark in the move, since the problem of burning oil in locomotive fireboxes was successfully solved fifteen or twenty years ago by Mr. Thomas Urquhart, locomotive superintendent of the Grazi Tsaritsin Railway, in Russia, where it is largely in use at the present time. In burning petroleum refuse, or the residue left after refining the crude oil, Mr. Urquhart had an evaporative efficiency of 14 pounds of water for each pound of the refuse consumed; but this result was obtained only by the most perfect appliances, devised by himself.

In this connection we will mention an instance of an unsuccessful attempt to burn oil in a locomotive, that recently occurred in this city. The trial was made on the Manhattan Elevated Railway, with an engine that was fitted up in accordance with somebody's scheme to burn oil and work out economies for the corporation, on the assumption that the latter was impoverishing the stockholders by the immense coal consumption of its engines. The trial proved a miserable failure on two accounts—lack of steam and clouds of black smoke. This result must be ascribed to the "system" under trial, and not to the fuel.

Oil as a fuel has everything to recommend it to railroad companies in this country except the supply, the scarcity of which, if its use became general, would put the price at a prohibitive figure. The matter assumes a very different aspect, however, when viewed as an individual case and the supply is contained within the field of operations, as in the instance of the Southern Pacific Railway.

Muffling the Exhaust in Stations.

The unearthly, ear-piercing noise of the exhaust of a locomotive as it backs out of the station after having brought its train in on time, perhaps, is one of the annoying features of travel which can and should be remedied. This nuisance is particularly true of the suburban service, where the trains have to be got out of the way about as soon as the passengers are out of them. Then the engine backs out, with its sharp, ear-splitting noise, past the passengers who are hurrying out of the station, anxious to get out of range.

A few roads have taken steps to prevent this annoyance, and have accomplished it very easily and cheaply, simply having an exhaust damper which is turned down over the tips while in the station, and thrown up out of the way as soon as the open air is reached.

The device used on the Boston & Maine Railroad was illustrated in our issue of May, 1896, and a similar device has been in use on the Pennsylvania lines for some time. They cost very little to apply, and they save a heap of cuss words on the part of the male passengers, as well as tall thinking by those who feel duty bound to say nothing, no matter what they think.

Favors More Light.

The ingenuity of shop managers has been severely taxed during the last few years to devise means of doing the work at less cost, and as a rule great improvements have been effected. Many labor-saving tools have been designed, systematic methods of doing work have been extended, and tools have been worked up towards their full capacity to a greater extent than ever practiced before. But we have noticed in visiting some shops that making the best of an element which saves much and costs nothing has been sadly neglected in some quarters. This is the use of light and sunshine. It seems incongruous to walk through a shop which is dotted with all kinds of appliances for facilitating the work, and to find the men using smoky torches to see what they are doing, owing to the light of the sun being obscured by smoke, dust, cobwebs and other opaque substances covering part of the window glass.

The writer feels personally wounded in this exclusion of light question. He once accompanied a shop foreman to look at a small compressed air engine operating a cylinder boring mill and fell into a hole in the floor. A little less dirt on the windows and consequently more light on the floor would have shown the pitfall.

Where through mistake of construction or through the near vicinity of other buildings a shop is badly lighted, much improvement may be effected by keeping the walls, pillars, rafters and roof white-washed. The compressed air operated paint sprinklers make the work of applying a coat of whitewash very light. Clean windows, white walls and orderly floor are features that proclaim the good shop foreman. Where murkiness and dirt prevail they point to an inefficient foreman, no matter how many labor-saving devices he may have invented or built.

Underselling British Rail-Makers.

One of our rail-making companies sold several thousand tons of steel rails and rail fastenings some time ago to a railway in India, and the transaction has been discussed in the British Parliament. It was explained that the reason why the Americans got the order was that they underbid their British competitors $5 a ton.

In discussing this case, we notice that the newspapers on the other side say that American steel makers are able to sell rails very cheaply abroad, because under our system of high protection they make enormous profits at home. It is becoming very common to find in the British press expression of the sentiments that free trade is too one-sided and that a little of it would benefit the British Empire.

From what we have seen of the rail-making works in the United States and in Great Britain, we are inclined to think that our steel makers undersell their British rivals because they can finish a ton of rails for considerably less money than it costs their rivals. This comes principally from the perfected methods of manufacture introduced into our leading rolling mills. Instead of moving for protection, the British steel makers would do better to first see what they can do with improved mechanical appliances.

The Collarless Axle and Hot Boxes.

To the traveler of an inquiring mind, there is a limitless field for the exercise of his quizzing propensities, in the stops made necessary by a blazing box. We once saw him take the chance to get his needed exercise, and at the same time satisfy the cravings of those interrogation points which are dormant while the wheels are rolling, but full of life at the first sight of the dope bucket. The first man to be in the way and the last one to be out of it, while the train crew was engaged in lowering the temperature of the heated journal; prolific in suggestions, and without the remotest idea of the causes producing the visible effects, he returns in due time to his car, unable to satisfy his desire for information, or to understand why he is fated to be laid out on his journey.

The old-time motive-power man who was on this same train understood well enough what the stop was for, by the unmistakable bouquet wafted to his olfactories from the warming box, and, settling back in his seat, made the best use of his time by recalling to his memory all of the conditions leading up to the heating of journals, and the schemes resorted to by the best thinkers, to bring the record as low as possible. Fast came the facts of his ripe experience to help unravel the tangle of a complex problem. Back his thoughts revert, twenty-five years, to a period embracing the time when the Atlantic & Great Western (now a part of the Erie system) used the collarless axle on everything, and how that, when the Erie absorbed that road, the collarless axles could not be made to run cool, and had to be replaced with collared axles at an immense cost before the trouble ceased; the good monitor also reminding him that this was before the stop wedge came into use, the stop being cast in the boxes referred to.

Following this line of thought down to the present time, he saw little improvement in either type of axle, except an increase in size; the stop-wedge having been introduced, which constituted practically the only change from that time to this, while the collared journal and bearings remain unchanged in design. A comparison of the results obtained by himself with the collared axle in freight service had caused him to look with favor on that type for passenger trucks, and he mentally resolved that he would at once and forever settle the hot-box question his way.

But our recent observations on the rail lead to the belief that the old-timer has not had proper encouragement in working the revolution he so ardently set out to do. And they are still with us; but it is an easily authenticated fact that roads which use the collared axle in passenger service claim that they have no hot boxes—absolutely none. If these claims can be substantiated, it is quite plain that a mistake is perpetuated by those who use the other kind, which certainly have the peculiarity of getting warm occasionally.

Report of the Proceedings of the Thirty-First Annual Convention of the Master Car Builders' Association.

A book of 443 pages, 6 x 9 inches, bound in half-morocco, and containing a full and complete digest of the work transacted at the Master Car Builders' convention of June, 1897, has been issued by Secretary Cloud.

The arrangement and editing of the material entering into a work of this character is a task of no mean magnitude, as the contents give ample evidence. The reports of the committees, and the discussions thereon, show no falling off of interest among the members. A very prominent feature of the report is the masterly manner in which the technics of the details of car design are treated; it is truly an index of progress.

With the plates showing standards and recommended practices of the association, the report is one that should be indispensable to all car-department men, if they expect to keep in touch with facts and details of their business which are the key to their advancement. The price of the report is $1.50, and it can be obtained from John W. Cloud, Rookery, Chicago.

Mr. John W. Cloud, secretary of the Master Car Builders' Association, informs us that the rules governing the loading of lumber and timber on open cars, and loading and carrying structural materials, plates, rails, girders, etc., as revised at the convention of 1897, are now ready for delivery, prices as below: 25 copies, $1; 50 copies, $1.75; 100 copies, $3.

A less number than twenty copies at 5 cents per copy. Postage will be added when sent by mail.

Shipment of more than fifty copies will be by express, and order should designate the express company, if one is preferred.

His address is 974 Rookery building, Chicago, Ill.

We are informed by the St. Louis Car Coupler Co. that they are about to appeal against the decision of the United States Circuit Court in their suit against Shickle, Harrison & Howard. They intimate that they intend to vigorously assert their rights under their patents and to institute proceedings against all parties infringing on their patents until their rights are finally determined by the court of last resort.

BOOK NOTICES.

"The Express Messenger and other Stories of the Rail." By Cy Warman. Published by Charles Scribner's Sons, New York. Price $1.25.

This is a volume of about 235 pages and contains eleven stories, all of which will interest railroad men. One charm of the book is that most if not all of them are founded on fact, most of them being laid in Colorado, the Denver & Rio Grande Railroad being mentioned a number of times, while the main fact in "The Locomotive That Lost Herself," is vouched for by W. A. Deuel, general superintendent of the Union Pacific, and J. W. Gilluly, treasurer of the Denver & Rio Grande. The author writes in an easy and interesting manner, and the book should meet with a ready sale, especially in railroad districts.

The Engineers' Sketch Book of Mechanical Movements. By Thomas Walter Barber. Published by Spon & Chamberlain, 12 Cortlandt street, New York. Price, $4.

This book is well named, it being a collection of sketches of mechanical movements and devices for about all classes of work, including a little locomotive practice regarding rod ends, etc. The book is full of interest to the engineer, and should be a help in many instances, as it shows devices which have been used for a large variety of purposes. Nearly half the book is devoted to illustrations, there being 2,603 sketches and a very brief description of each, as well as other information. The author states in the preface that "every successful engineer is an inventor." This we do not agree with, but it of course in nowise affects the value of the book. There are 335 pages, 5½ x 9 inches.

"Modern Locomotives." By David L. Barnes and J. C. Whitridge. Published by "The Railroad Gazette," New York, N. Y. Price $7.

This is a volume of 405 pages, 11½ x 16 inches, which was begun by Mr. D. L. Barnes and completed since his death, by Mr. J. C. Whitridge. The text comprises chapters on Recent Improvements in Locomotives, Locomotive Counterbalancing, Locomotive Tests, Locomotive Testing Plants and Experiments with Exhaust Apparatus, together with data of the engines illustrated.

There are 209 American steam locomotives shown, many of them being in detail, with fairly complete specifications.

European practice is not so completely shown as the American, for obvious reasons, it being much more difficult to procure these than the American locomotives. Compound locomotives also receive a good share of attention.

There is a table of 137 fast or unusual runs made by regular or special trains in various parts of the world. As a reference this will prove of value to many.

The electrical situation is shown by 24 electric motors for various uses, while five compressed air motors show the developments in that line.

There are many scale drawings, with dimensions, which will be of service to the students of modern locomotives. We believe this will be a very acceptable volume to those who wish to know what has been done in this line in recent years.

"Railway Track and Track Work." By E. E. Russell Tratman. Engineering News Publishing Co., New York. Price, $3.

This is a book of 418 pages, 6 by 9 inches, devoted to the important subject of permanent way. It considers roadbed, ballast, ties and tie-plates, rails, fastenings, joints, and in fact about all the questions of railway track work that occur in practical work. The author is one of the well known editors of the "Engineering News," and the book shows evidence of careful work. It is thoroughly illustrated, dimensioned drawings being given in many cases, which adds to its value for reference or as an aid to designing similar work. Any man having charge of track work will find it of value.

"Calculus for Engineers." By John Perry, F. R. S. Published by Edward Arnold, 70 Fifth Avenue, New York. Price, $2.50.

The author is an instructor in the Finsbury Technical College, London, and has given a portion of the studies which his students have found most useful. The readers are assumed to have an elementary knowledge of mechanics and to be fairly familiar with algebra. Some of the uses of squared section lined paper are shown and its application to problems of the calculus is interesting. The book is a very thorough treatise of the subject and has many practical applications in engineering problems, but the mathematics are enough to appall the ordinary mechanic. To the few who are determined to study all that may be of value, we recommend the book.

New York and Boston are trying to keep abreast of the times in the matter of mail transportation, and each city is hurrying forward the completion of the pneumatic tube conduits that form part of the Batcheller rapid postal despatch system, which they have adopted.

To operate the system New York is to have two air compressors, with steam cylinders of 13 inches diameter and air cylinders 26 inches diameter by 20 inches stroke, and one compressor with cylinders 10 inches and 24 inches diameter, respectively, steam and air, by 20 inches stroke.

Boston is also to have two air compressors of the latter size. All five are to be "duplex," and the Rand Drill Co. of 100 Broadway, N. Y., has the contract for them.

PERSONAL.

Mr. Edwin McNeill, president of the Oregon Railroad & Navigation Co., has retired.

Mr. M. B. Cutter, superintendent of the Baltimore & Ohio at Pittsburg, Pa., has resigned.

Mr. J. S. Chambers, master mechanic of the Illinois Central, at Paducah, Ky., has resigned.

Mr. Sheldon T. Bent has been appointed general superintendent of the Interoceanic Railway of Mexico.

Mr. A. Fenwick, master mechanic of the Green Bay & Western Railroad at Green Bay, Wis., has resigned.

Mr. F. W. Huidekoper, who has been president of the Chicago, Peoria & St. Louis for several years, has resigned.

Mr. John S. Thurman has been appointed mechanical engineer of the Missouri Pacific Railway, with office at St. Louis, Mo.

Mr. W. B. Beamer, superintendent of the Southern California has removed his headquarters from Los Angeles to San Bernardino, Cal.

Benjamin Brewster, vice-president of the Chicago, Rock Island & Pacific, died at his summer home at Casanova, N. Y., last month, at the age of 69 years.

At a recent meeting of the directors of the Suffolk & Carolina Railway, Mr. George L. Barton was elected general manager, with office at Suffolk, Va.

Mr. W. P. Raidler, master mechanic of the St. Louis & Hannibal, has resigned to accept a similar position on the Green Bay & Western, with office at Green Bay, Wis.

The headquarters of Mr. Thomas A. Davies, master mechanic of the Wyoming division of the Union Pacific, have been changed from Laramie, Wyo., to Ogden, Utah.

Mr. H. A. Gillis, formerly master mechanic of the Western division of the Norfolk & Western, has accepted the general superintendency of the Richmond Locomotive Works.

If any small railroad in need of a good master mechanic will communicate with us, we can place them in correspondence with a man whom we believe would be satisfactory.

Mr. E. W. Hayes, superintendent of motive power and machinery of the Fort Worth & Denver City, at Fort Worth, Texas, has resigned and that office has been abolished.

Mr. W. H. B. Rosing has resigned the position of master mechanic of the Denver & Rio Grande, to return to his old position of mechanical engineer of the Illinois Central.

Mr. Mason Rickert, mechanical engineer of the "Big Four," has been promoted to the position of master mechanic of that road at Delaware, O., vice Mr. J. A. Keegan.

Mr. R. L. Ettinger has been appointed mechanical engineer of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Indianapolis, Ind., vice Mr. Mason Rickert, promoted.

Mr. W. E. Killen, master mechanic of the St. Louis, Chicago & St. Paul, has also been appointed master mechanic of the Chicago, Peoria & St. Louis, with office at Springfield, Ill.

Mr. D. T. Bound has been appointed general superintendent and purchasing agent of the Wilkesbarre & Northern, with office at Wilkesbarre, Pa., vice Mr. A. A. Holbrook, resigned.

Mr. W. P. Orland has been appointed master mechanic of the St. Louis division of the Cleveland, Cincinnati, Chicago & St. Louis, vice Mr. G. S. McKee, resigned. Headquarters at Mattoon, Ill.

Mr. J. A. Keegan, master mechanic of the Cleveland, Cincinnati, Chicago & St. Louis, at Delaware, O., has been promoted to the position of superintendent of terminals at Cincinnati, O.

Mr. Ross W. McConnell has been appointed foreman of the Santiago shops of the Mexican National Railroad at the City of Mexico, Mex. He was formerly with the Monterey Foundry & Machine Co.

Mr. A. L. Moler, for the past two years master mechanic of the Cincinnati, Hamilton & Dayton at Hamilton, O., has been appointed master mechanic of the St. Louis, Peoria & Northern at Springfield, Ill.

The office of trainmaster on the Minneapolis & St. Louis has been re-established and Mr. Charles E. Dafoe, chief train dispatcher, has been promoted to that position. Headquarters at Minneapolis, Minn.

Mr. H. G. Hudson has been appointed master mechanic of the Cairo division of the Cleveland, Cincinnati, Chicago & St. Louis, with office at Mt. Carmel, Ill., vice Mr. W. P. Orland, transferred to St. Louis division.

Mr. Wliam Coyne, train dispatcher of the Minneapolis & St. Louis, has been promoted to the position of chief train dispatcher, taking the place left vacant by the promotion of Mr. Dafoe. Office at Minneapolis, Minn.

Mr. A. G. Wells, general superintendent of the Santa Fé Pacific has also been appointed general superintendent of the Southern California, and has removed his headquarters from Albuquerque, N. M., to Los Angeles, Cal.

Mr. J. W. Brown, president and general

manager of the Annapolis, Washington & Baltimore, has also been chosen president and general manager of the Baltimore & Annapolis Short Line, to succeed Mr. J. S. Ricker, resigned.

Mr. J. T. Blair has been appointed general manager of the Colorado & Northwestern, which is under construction from Boulder to Ward, Colo. He was formerly general manager of the Pittsburg, Bessemer & Lake Erie.

Mr. Fred Mertsheimer, master mechanic of the Union Pacific at Armstrong, Kan., has resigned to accept the position of superintendent of motive power of the Kansas City, Pittsburg & Gulf, with headquarters at Kansas City, Mo.

Mr. A. McCormick has resigned his position as general foreman of the machinery department of the Chicago, Rock Island & Pacific at Goodland, Kan., to accept the position of master mechanic of the Chicago & Alton at Slater, Mo.

Mr. James I. Blakeslee, having resigned the position of superintendent of the Pottsville division of the Lehigh Valley, that office has been abolished, and that division will hereafter be operated as the Pottsville branch of the Lehigh division.

Mr. James Roberts, general foreman of the Union Pacific shops at Armstrong, Kan., has been promoted to the position of master mechanic of the Kansas division of that road, taking the position left vacant by the resignation of Mr. Mertsheimer.

Mr. F. C. Losey has been appointed master mechanic of the Water Valley shops of the Illinois Central, with jurisdiction over the affairs of the machinery department of the Mississippi division, vice Mr. W. Hassman, transferred. Office at Water Valley, Miss.

Mr. C. F. Quincy, of the Q. & C. Co., Chicago, Ill., has been elected a director of the Iowa Central, and has also been appointed honorary commissioner for the State of Illinois to the Trans-Mississippi and International Exposition to be held at Omaha, Neb., in 1898.

Mr. William A. Canty, formerly of the Screw Machine Department at Pratt & Whitney Co., Hartford, Conn., has severed his connection with that company, to take the superintendency of the Screw Machine Department of the Davis & Egan Machine Tool Co., Cincinnati, O.

Mr. W. Hassman has been appointed master mechanic of the Paducah shops of the Illinois Central, with jurisdiction over the affairs of the machinery department on Louisville division and Fulton district of the Memphis division, in place of Mr. J. S. Chambers, resigned. Office at Paducah, Ky.

Mr. A. L. Mohler, vice-president and general manager of the Oregon Railroad & Navigation Co., has been chosen president, to suceed Mr. Edwin McNeill, retired. Mr. Mohler went to the Oregon Railroad & Navigation Co., last May, and for three years previous to that was general manager of the Minneapolis & St. Louis.

Mr. W. B. Baldwin has been appointed master mechanic of the McComb City shops of the Illinois Central, with jurisdiction over the affairs of the machinery department of the Louisiana division, vice Mr. F. C. Losey, transferred. Office at McComb City, Miss. Mr. Baldwin was formerly general foreman at New Orleans.

At the annual meeting of the Iowa Central in Chicago last month, Mr. H. J. Morse was chosen president of that road to succeed Mr. Russell Sage. Mr. Morse has been connected with the Iowa Central for many years, having formerly been vice-president for many years. He is also connected with several large trust and banking companies in New York and Brooklyn.

The receivers of the Baltimore & Ohio are giving the Pittsburg interests of the company considerable attention, and have selected Mr. William Gibson, assistant general superintendent of Baltimore, to go to Pittsburg as assistant general superintendent, with full charge of all the Pittsburg and Wheeling divisions and of the Pittsburg terminals. Mr. Gibson was born in Edinburgh, Scotland, and came to the United States at the age of 21, when he entered the service of the Cincinnati Southern as secretary to the president Later he went with the Cincinnati, Hamilton & Dayton as trainmaster, and left there in 1887 to go with the Columbus, Hocking Valley & Toledo as car service agent. In 1889 he went with the Cleveland, Cincinnati, Chicago & St. Louis as chief clerk to the general manager, Mr. William M. Greene, who is now general manager of the Baltimore & Ohio. A year ago Mr. Greene took him to the Baltimore & Ohio as his secretary, and last January he was appointed assistant general superintendent.

EQUIPMENT NOTES.

The Carter Brothers are building eight freight cars for the Occidental Railroad.

Ten passenger cars are under construction at Pullman's for the Southern Pacific Railway.

The Armour car lines are having 500 freight cars built by the Wells & French Company.

One car is being built for the Pennsylvania Oil Refining Company, at the Erie Car Works.

The Warren Oil Refining Company are to have five freight cars built at the Erie Car Works.

Two hundred freight cars are under construction at Pullman's, for the Illinois Central Railway.

The Pullman Company are constructing one passenger car for the Atlantic & West Point Railroad.

The St. Charles Car Company are building 400 freight cars for the St. Louis & Southeastern Railway.

The Jalapa & Cordova Railway have ordered twelve freight cars from the St. Charles Car Company.

The Ensign Manufacturing Company are building two freight cars for the Canda Cattle Car Company.

Two switch engines are to be built for the Wiggins Ferry Company at the Baldwin Locomotive Works.

Ten engines for the Imperial Railway of Japan are well under way at the Schenectady Locomotive Works.

The Swift Refrigerator Car Company are to have 300 cars built by the Michigan Peninsular Car Company.

An order for 1,000 freight cars has been placed with the Pullman Company by the Chesapeake & Ohio Railway.

Five ten-wheeled engines for Florida East Coast Railway are under way at the Schenectady Locomotive Works.

The Continental Freight and Express Company are to have 200 freight cars built by the Wells & French Company.

The Wells & French Company are building 1,000 freight cars for the Chicago, Burlington & Quincy Railroad.

The Rogers Locomotive Works are building eight six-wheel connected engines for the Lu Ham Railway, of China.

The Brooks Locomotive Works are constructing two six-wheel connected engines for the Jalapa & Cordova Railroad.

The Pittsburg Locomotive Works are building five consolidation engines for the Chicago & Eastern Illinois Railroad.

The Pullman Company have an order for 1,000 freight cars from the Cleveland, Cincinnati, Chicago & St. Louis Railway.

The Haskell & Barker Car Company are engaged on an order for 150 freight cars for the Green Bay & Western Railroad.

The Chicago, Milwaukee & St. Paul Railway are to have ten consolidation engines built at the Baldwin Locomotive Works.

Twelve consolidation engines for the Chesapeake & Ohio Railway are being built at the Richmond Locomotive Works.

The Kansas City Suburban Belt Line are having two six-wheel connected engines built at the Baldwin Locomotive Works.

The Burlington, Cedar Rapids & Northern Railway have placed an order for two passenger cars with the Pullman Company.

Two hundred freight cars for the Con-

(*Continued on page 782.*)

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

New Air-Brake Repair and Instruction Rooms of the St. Paul & Duluth Railroad Company.

Editors:

I herewith submit several views of our new air brake plant, completed and opened May 6, 1897, with an attendance of 54 road men in active service. Since the room was opened the daily attendance has averaged 29 men.

St. Paul being the southern terminal, and as nearly all engine and train crews lay over at this point, it was deemed best by the management to have a room instead of a car for instruction purposes. This was also appreciated on account of the advantges that a room has over a car in respect to frontage, as frontage for class purposes is limited when a car is employed.

The building comprising the plant is built of brick, and was erected expressly for this purpose. The dimensions are 24 by 48 feet. Hight of ceiling is 16 feet from the basement. It is divided into two parts, one for repair work, the other for instruction.

Five colors are employed to distinguish one thing from another. Main reservoir connections are painted red, train pipe for brakes is blue, train pipe for signal blue with red stripe, giving the apparatus a military appearance. Yellow is employed for equalizing reservoir and connections, all brake cylinders are brown and auxiliary reservoirs are green. The colors and finished brass give the rack an attractive and ornamental appearance.

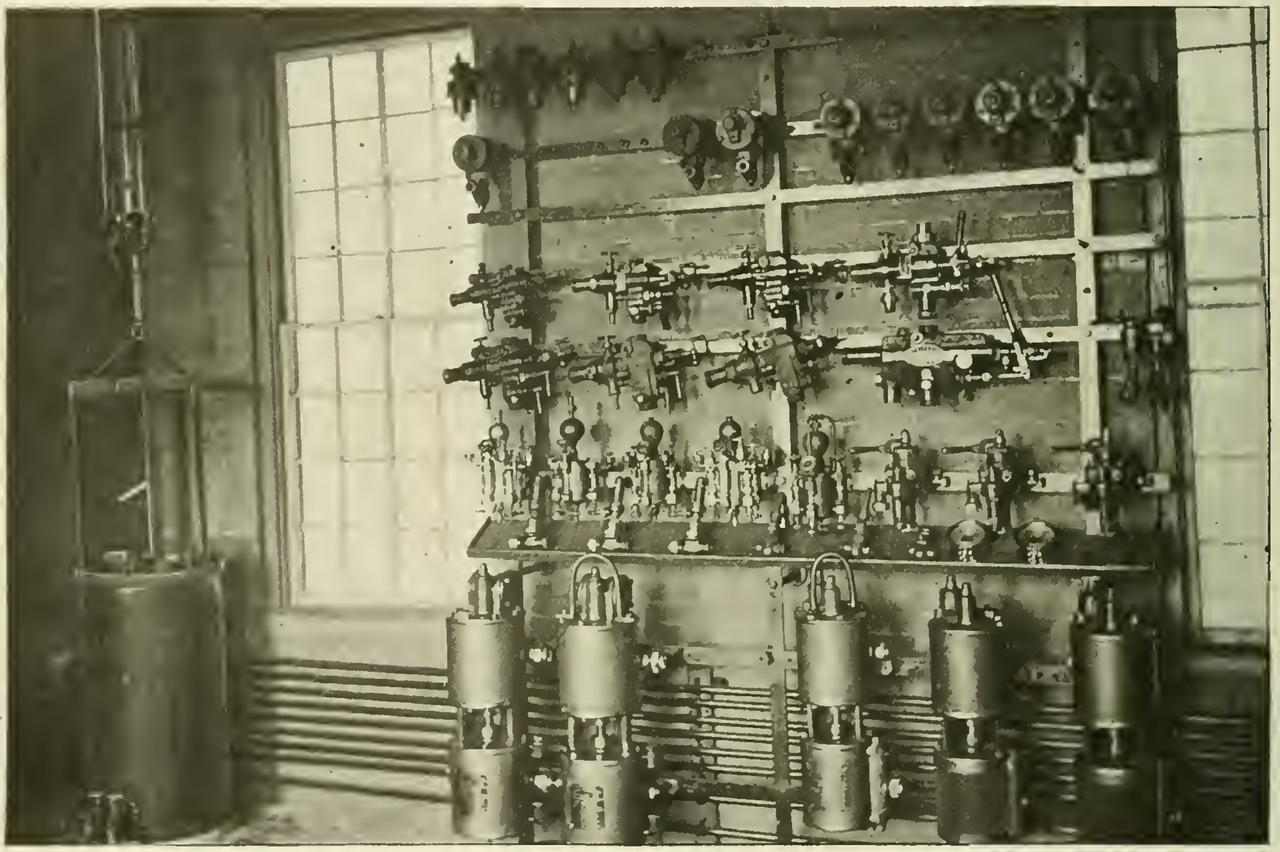
A Rand air compressor is located in the engine room and furnishes the plant with pressure at 125 pounds.

The educational equipment in the instruction room is shown in six views.

View No. 1 is a portion of the repair room, showing rack for hanging the various parts; also lye tank for cleaning purposes. The dimensions of the tank are 24 inches diameter by 40 inches long. The tank is heated by steam, and has a cage with perforated bottom, which can be raised or lowered. While the cage is suspended all drainage drips into the tank. It is also conveniently loaded and unloaded. The cage, as shown in view, is raised, lowered and suspended by air hoist that is hung on an overhead traveler, which travels with its load around the room, reaching all desired points.

No. 2 is what we call the engine and tender rack, which consists of the parts shown in the photograph. Full length of train pipe on engine and tender for brakes and signal are located on rear of rack. Three duplex gages are used. The one upon the left shows main reservoir, and both train pipe pressures, as it can be connected by means of a cock to either brake or signal train pipes. The gage on the right shows brake cylinder and reservoir pressures. The center gage is connected to the equalizing reservoir of the brake valve and the train pipe on the thirteenth car. The two pointers on this gage show in a very impressive way the equalizing discharge feature of the 1892 valve.

Brake cylinder rack is shown in view No. 3, upon which 13 brake cylinders are operated. This number includes the sectional cylinder, as the piston in this cylinder operates with the others. This is accomplished by placing a 3½-inch cylinder below and attached to floor, the piston rod passing through floor, triple valve and tube in auxiliary reservoir to under side of piston in sectional cylinder. The cylinder below floor is connected to triple valve on the eleventh car, and opening being made on side of triple valve between the emergency piston and valve.



VIEW NO. 1—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST PAUL, MINN.

When valve operates to supply or release pressure from its own cylinder it also supplies and releases cylinder below floor. The capacity of auxiliary reservoir has been increased to supply this additional demand.

Eight slotted sleeves are employed to give variations in piston travel. The slot permits the travel to be seen, and in addition, oak blocks of different lengths can be passed into the sleeves. Six duplex gages show the pressure in an equal number of reservoir and brake cylinders.

View No. 4 is the foundation brake rack that occupies a floor space of 2½ by 14 feet. One end has the freight, or Stevens system of levers, while the other has the passenger or Hodge system, with their respective hand brake staffs. Both systems are operated by the same brake cylinder. This is the last car in train, but can speedily be changed to first car, as train pipe for engine is also connected to the train pipe of the last car, and all that has to be done when this change is desired is to cut it in.

View No. 5 shows blackboard located in front of foundation brake rack, the dimensions being 3½ by 12 feet. It is suspended on two sliding pivots, which permits board to be turned so that either side can be used, or raised and lowered as the occasion may demand. Slide is guided by two pipes that extend from floor to ceiling. Weight of board is counterbalanced by two bars of iron that slide inside of pipes. The various parts on side of board, as seen in view, are painted with exception of gage and triple valves. Both triple valves are in section, as they have been cut in two. One half is set into the board with all internal parts whole, and are free to move to and from their several positions. The same colors that are employed on the apparatus to express the different parts are used on the board. This adds to its appearance, and the triple valves being real, makes it not only a picture, but a living picture. It brings the whole apparatus, including parts on engine, tender and coach on one plane and on a large scale. The other side of board is blank for crayon sketches, or examples in figures.

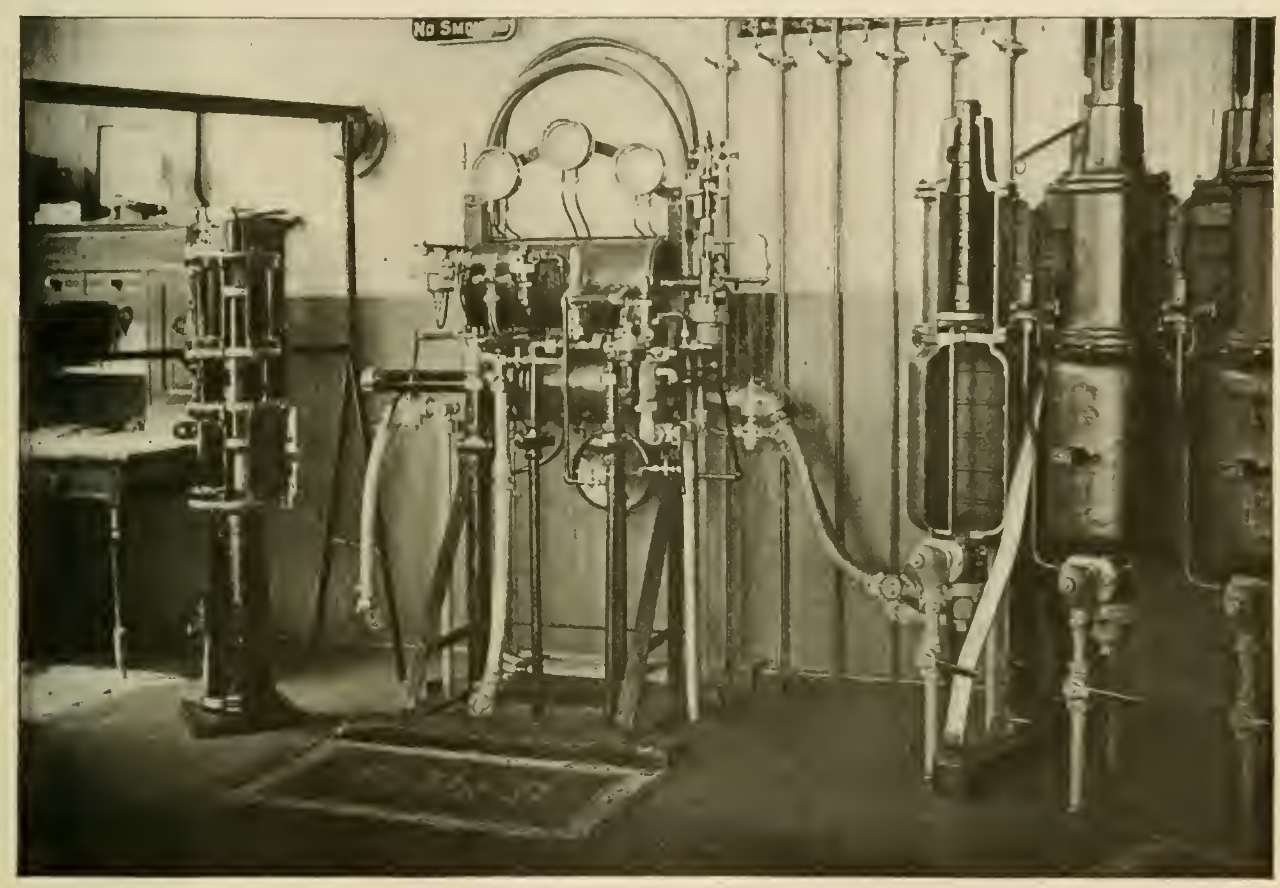
View No. 6 shows two revolving tables, one for sectional lubricators and injectors. The other and larger table is mounted with all sectional parts for air brake and air signal, and all miscellaneous pieces for same. This table can be raised and revolved enabling any piece to be brought in front of class. Each piece is pivoted upon a bracket that is also free to revolve, so that each sectional piece on table can be turned or made to occupy any desired angle. For example, top head for 9½-inch pump rests upon a bracket shaped like the letter U. Bracket revolves upon its center, while head revolves in bracket. Left main valve cylinder head can be removed, main valve, slide-valve and bush for same can be taken out while head rests upon bracket.

The train pipes for brakes and signal are located in the basement, and are built in coils one above another, one coil being equal to one length of train pipe. Coils are 5 feet wide, 16 feet long and 13 coils in all. It is one continuous line of pipe, no hose or angle cocks being used, but instead 1¼-inch cut-out cocks are employed to separate one train pipe from another. Rods with sockets on one end to fit square on plug of cut-out cock extend through the floor, with handles on upper end. They can be seen directly below brake cylinder rack in view No. 4, where they can be conveniently reached. A tee and 1¼-inch cut-out cock are placed in sixth train pipe to produce the condition of a train parted.

Train pipes for air signal are built up in the same way, the coils being 4 feet wide, 28 feet long and 10 in all. One ¾-inch cock for each pipe with rods and handles for same. Handles are located above floor behind engine and tender rack.

We have been using this apparatus for instruction purposes for a period of two months. This short experience has enabled us to appreciate the manifold advantages to be gained from such an equipment.

The blackboard and the foundation brake rack have been especially helpful, both to instructor and instructed. Being of a kindergarten character they simplify preliminary work, and are a constant ready reference for further advanced stages in



VIEW NO. 2—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST. PAUL, MINN.

air brake knowledge. The operations of the plain and quick action triple valves can be easily apprehended, as all port openings and passages are exposed to view.

GEO. R. PARKER,
A. B. Insp. & Inst. St. P. & D. R. R.
St. Paul, Minn.

Train-Pipe Air in Quick Action.

Editors:

Referring to the statement made by you in the August issue of "Locomotive Engineering," refuting the claim made by Mr. Willetts that four-fifths of the air supplied to the brake cylinder in a full emergency application was supplied by the train line, I want to ask if you are not somewhat mistaken, and is not Mr. Willetts' statement nearer correct than your own?

Some time since, this same question regarding the relative amount of air supplied by the train line and auxiliary in a full emergency application sprung up among the employés interested in the air brake problem on this road, but was never settled satisfactorily or to my liking, and if you will kindly grant me a little space, I think I can clear away the mystery and give a simple method by which the exact amount of pressure, or air, each supplies to the brake cylinder in a full emergency application can be determined.

The law of Mariotte states that the pressure and volume of a perfect gas will vary inversely, that is, if we double the volume we reduce the pressure one-half, and vice versa. It is also stated that the product of the pressure by the volume is constant.

In all emergency applications full equalization of pressure takes place between the brake cylinder and auxiliary reservoir, so that if they equalize at a higher pressure than 50 pounds per square inch, the amount of a full service application, the difference must be supplied by the train line.

Now let us work out an example in which a full emergency application has been made and the pressure obtained in the brake cylinder is 60 pounds. The brake cylinder to be eight inches in diameter and the piston to have a stroke of eight inches. In a cylinder of this size, with the piston out full distance, the cubical capacity will be $8 \times 8 \times .7854 \times 8 =$ 402 cubic inches.

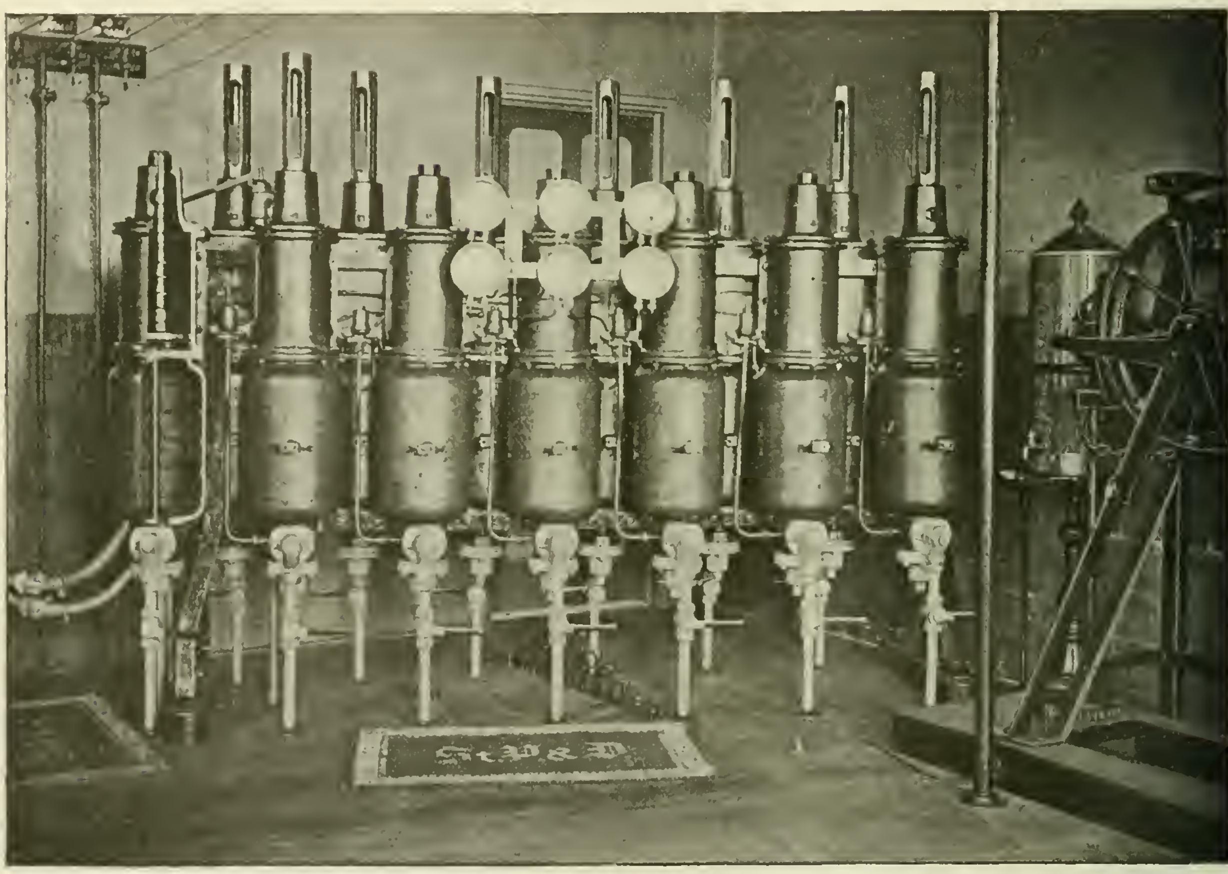
With a reduction of ten pounds from the auxiliary in ordinary service application we get a pressure of about twenty-five pounds in the brake cylinder, and as the amount of reduction is no more in full emergency all we need to do is to find the amount of space the air in the brake cylinder at twenty-five pounds pressure will occupy when raised to sixty. As the product of the volume by the pressure is always constant, we multiply 402 by 25, which gives us a product of 10050. By dividing this product by 60 we get a quotient of 167½, which is the number of cubic inches of space occupied in the brake cylinder by the air supplied by the auxiliary in an emergency application. The remaining space, or 234½ cubic inches, is the space filled by the train line.

Were the volume of air supplied by the train line to occupy the brake cylinder alone, it would give us a pressure of 35 pounds, or $\frac{35}{60}$ of the total amount. This reduced equals $\frac{7}{12}$ which is the exact amount of train line pressure in the cylinder, and is $\frac{2}{12}$ or ⅙, greater than the amount contributed to the brake cylinder by the auxiliary reservoir.

According to the foregoing I am willing to credit the train line with doing seven-twelfths of the work in full emergency, and also to believe that Mr. Willetts' statement was not far out of the way.

In general it may be accepted as true, that the higher the pressure obtained in an emergency application the greater will be the relative amount of air supplied by the train line.

JOHN P. KELLY,
New England R. R.
Sandy Hook, Conn.



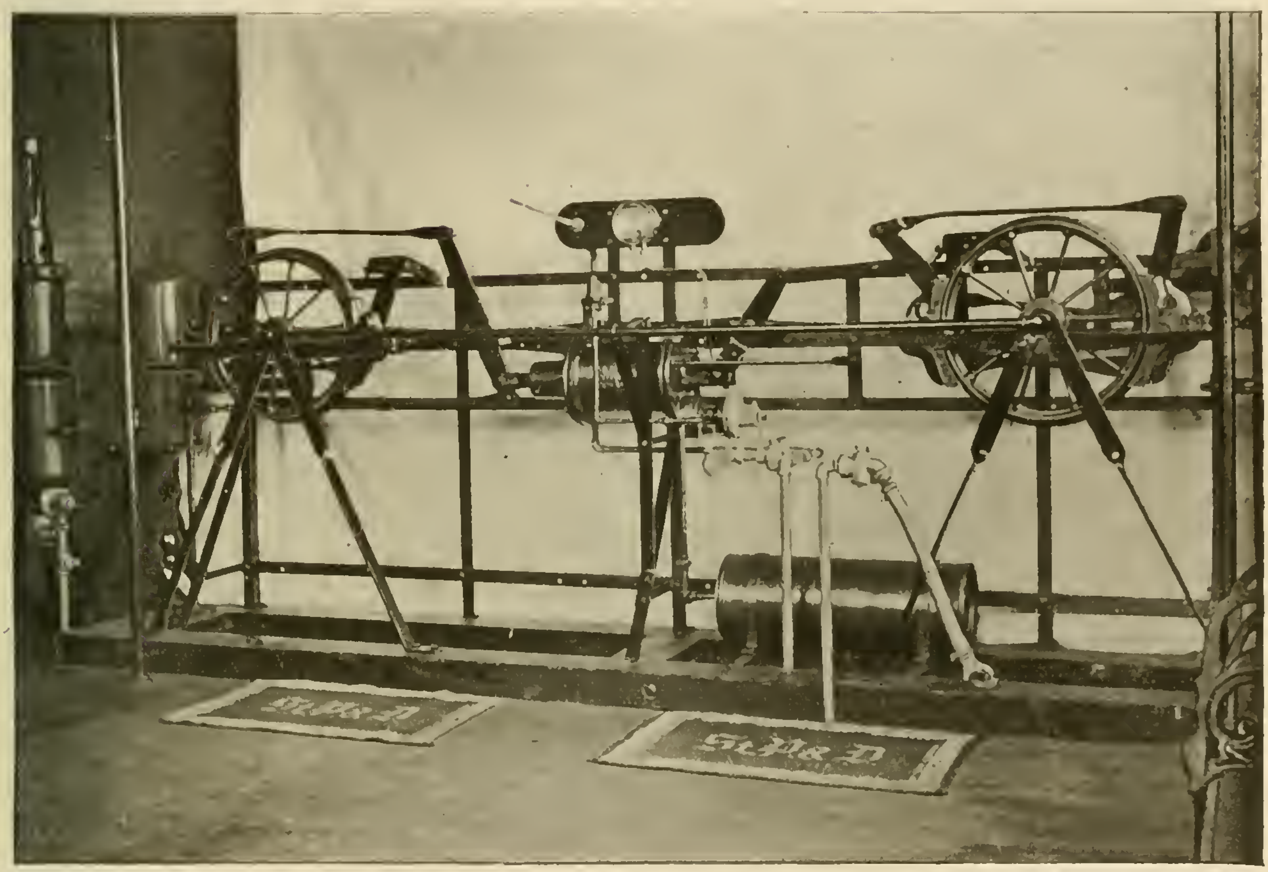
VIEW NO. 3—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST. PAUL, MINN.

[There are two or three objections to the solution offered by our correspondent. First of all, his solution depends upon the accuracy of his assumption that the discharge of sufficient air from the auxiliary reservoir into the brake cylinder, to reduce the auxiliary reservoir pressure from 70 to 60 pounds, produces a pressure of 25 pounds in the brake cylinder. This assumption is probably approximately correct, though it is doubtful that an eight-inch piston travel would result in so high a brake cylinder pressure as 25 pounds with a ten-pound reduction in the auxiliary reservoir. An important item to be remembered in such calculations is that, in a graduated application of the brakes, the air pressure from the auxiliary reservoir enters the cylinder much more slowly than the air from the train pipe enters the brake cylinder in an emergency application, and considerably more air would be lost through the leakage groove in the brake cylinder in a graduated application than in an emergency application.

The next serious defect in our correspondent's solution is his assumption that Mariotte's law refers to gage pressures instead of absolute pressures. To illustrate, let us consider his example. He assumes that, with an eight-inch piston travel, the brake cylinder volume is 402 cubic inches. This takes no account whatever of the clearance in the brake cylinder when the brakes are released. The brake cylinder clearance is somewhere in the neighborhood of a volume equal to that of one inch piston displacement, or about 50 cubic inches. The brake cylinder volume is therefore about 400 cubic inches for a seven-inch travel instead of an eight-inch piston travel. Passing this, however, let us regard the brake cylinder volume as 402 cubic inches, as Mr. Kelly has done. If now this space be filled with air at 25 pounds gage pressure, the absolute pressure (25 pounds gage pressure plus 14.7 atmospheric pressure) will be 39.7 pounds. The space occupied by 402 cubic inches of air at 25 pounds gage pressure, when compressed to 60 pounds gage pressure, will be found by multiplying 402 by 39.7, and dividing the product by 74.7, which indicates the space occupied at 60 pounds gage pressure as 214 cubic inches, instead of 167.5, found by Mr. Kelly, through multiplying 402 by 25, and dividing by 60. Deducting this space from 402 cubic inches leaves 188 cubic inches of space to be filled with air, at 60 pounds gage pressure, from the train pipe, instead of 234.5 cubic inches, as determined by Mr. Kelly, showing that a little less than half the air in an emergency application is furnished to the brake cylinder from the train pipe.

What appears to be a more satisfactory (though not entirely satisfactory) solution of the problem, is as follows: The cubical contents of the freight brake auxiliary reservoir is about 1,600 cubic inches. With a seven-inch piston travel of the eight-inch cylinder, the cubical contents, including clearance, is about 400 cubic inches. In a full service application, therefore, the combined contents of the auxiliary reservoir and brake cylinder are about 2,000 cubic inches of air at 50 pounds gage pressure. Suppose this air now be compressed into such space that the gage pressure shall be raised to 60 pounds. The volume of this space will be found by multiplying 2,000 by 64.7 (the absolute pressure of air at 50 pounds gage pressure) and dividing by 74.7 (the absolute pressure of air at 60 pounds gage pressure), which results in giving us 1,732 cubic inches. The difference between the volume occupied by the air at 50 pounds pressure (2,000 cubic inches) and that occupied by the same air at 60 pounds gage pressure (1,732 cubic inches) is the space which must be filled with air at 60 pounds pressure from the train pipe, and which is 268 cubic inches. As before stated, a portion of the air from the auxiliary reservoir is wasted by leakage through the leakage groove in any service application, so that the actual amount of air required from the train pipe in emergency applications is undoubtedly somewhat less than 268 cubic inches at 60 pounds pressure, as less air is lost through the leakage groove in an emergency application. This result is, however, undoubtedly much more nearly correct than that which we have calculated by the method adopted by Mr. Kelly.

Our correspondent has arrived at results which are not very far from the truth. Instead of 268 cubic inches of air at 60 pounds, from the train pipe, as we have calculated, it is probable that the actual amount of air taken from the train pipe into the brake cylinder at that



VIEW NO. 4—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST. PAUL, MINN.

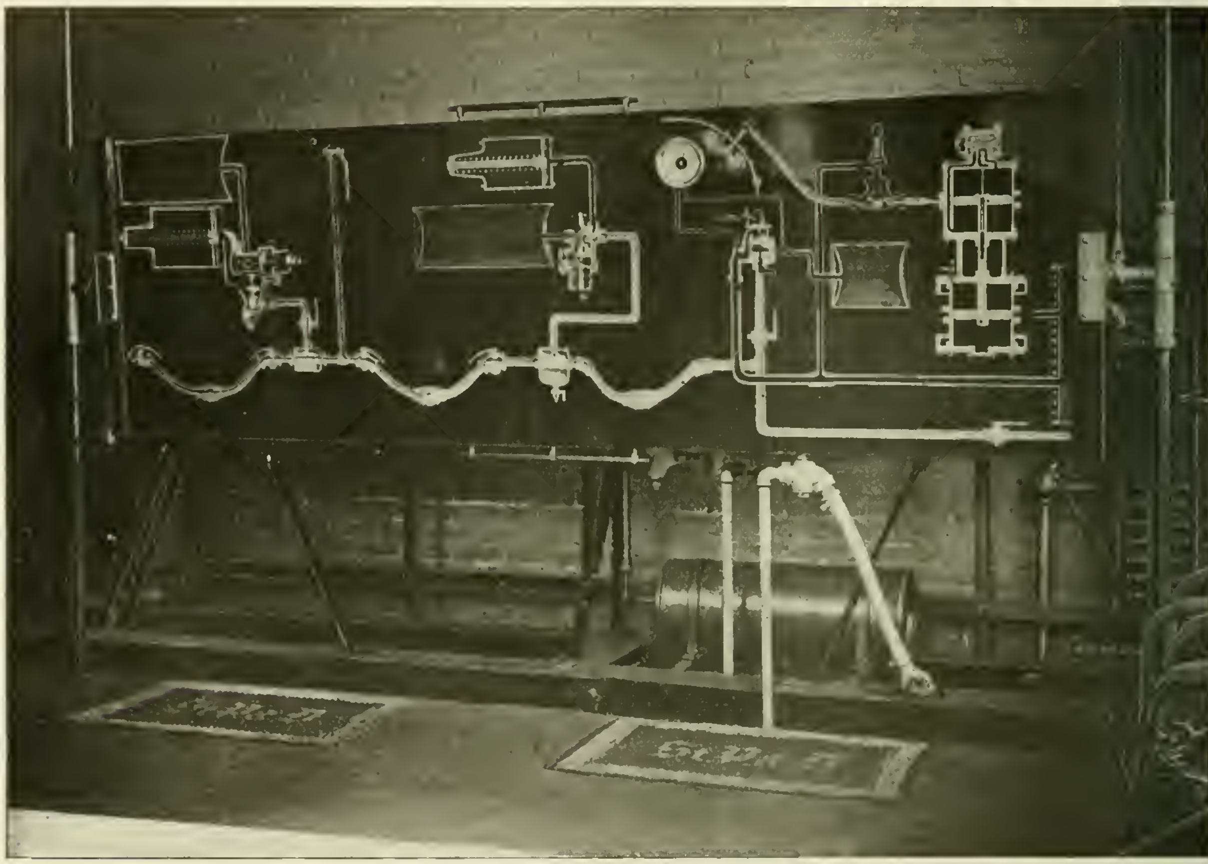
pressure would be between 250 and 200 cubic inches, so that Mr. Kelly's result of $234\frac{1}{2}$ cubic inches is not so very far from being correct. This, however, is due to accident rather than to any merit in the method employed. Similar calculations, in which gage pressures, instead of absolute pressures, have been innocently employed, and resulted with tolerable approximation to the truth, because other things, such as cylinder clearance, cooling of the air while forcing the piston out, etc., had been ignored, and their omission happened to partially offset the errors introduced through treating of gage pressures only. Such methods are unreliable and even dangerous.—Ed.]

pressure flows through the larger port to the brake cylinder much slower than it does in an emergency application through the smaller port on account of the graduating port being only partly open in service application. The degree of opening of the graduating port decreases as the length of the train increases. However, this cuts no figure in the above question; nor has any proof been submitted to substantiate the assumption that four-fifths of the brake cylinder pressure in an emergency application comes from train pipe. See article by Mr. Kelly elsewhere in this department on this question.—Ed.]

It is admitted that if both pipes *A* and *B* broke the brakes would apply.

brake cylinder. The air would pass out by *x* to the open air until such time as the pressure in pipe *A* had reduced very low.

Following is our comment quoted from same page on this feature, the truth of which will become readily apparent to those who will take time to study Mr. Willetts' brake on page 455, June number: "Should pipe *B* alone be broken or uncoupled when brake was on, all brakes would release. If brakes were not on, they could not be put on, and no knowledge of the fact would be had until an attempt was made to set brakes. If pipes *A* and *B* both broke, the brakes would apply with diminished force as described. If



VIEW NO. 5—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST. PAUL, MINN.

Mr. Willetts' Defense of His Brake System.

Editors:

Referring to my statement that train line air direct was four-fifths of the quick action. The difference gained between full service and an emergency application is quick action wholly. Train line air direct is the cause of this increase in pressure. If not so, why not? Is not the auxiliary connection to the brake cylinder smaller in an emergency than a service application?

[Ans. 1. The pressure going from the train line into the brake cylinder in an emergency application gives the increase over that had by a service application. Ans. 2. The port is constructed smaller, but there is no ratio of four to five. In a service application the auxiliary reservoir

Now, if pipe *B* alone was broken, left open or uncoupled, the brakes would apply also; for under these conditions, when the engineer's valve was turned to cause an application, the pipe *A* would be thrown into connection with pipe *B*, which is broken, or uncoupled. Hence the same result as if both pipes *A* and *B* were broken.

[The following quotation is admitted, which is from our comment in this connection on page 640, August number: "If the train broke in two, and the hose couplings on both pipes *A* and *B* were separated, the 'automatic cut-off valve' would not close until pressure in pipe *A* exerted less influence on parts *v* and *x* than the tension of the small spring above the latter. The triple valve, however, would respond immediately, and send air to the

pipe *A* alone should break, brakes would apply full force" (with auxiliary reservoir pressure).—Ed.]

The automatic cut-off valve will permit a certain amount of air to escape. It depends on the arrangement of the parts as to how much shall be allowed to escape before it is to close.

[Following is our quoted comment on this feature: "The 'automatic cut-off valve,' as shown on page 455, June number, consists of a non-return check valve *x* with a spring and a diaphragm valve *v*. Train pipe *A* pressure holds these described parts in the upper position as shown in the picture. So long as train pipe pressure on the under side of the diaphragm valve *v* will hold the parts up against the tension of the spring on top of the non-return check valve *x*, so long will there be a communication between the brake cylinder and pipe *B*. If pipe *B* alone broke at any point, or a connecting hose on that pipe burst or be left open and uncoupled, any air sent to the brake cylinder would go to waste to the atmosphere. —Ed.]

It (the automatic cut-off valve) has an interesting point to look at, as it can be so arranged that it will give an application equal to a service stop instead of an emergency, should the train part. This would make quite a difference should it be a forty-car train with the twenty head cars equipped with air and the separation should take place at the head end.

[The whole matter is controlled by the degree of tension of the spring on check valve *x* of the "automatic cut-off valve." If it be made very stiff, in the event of train parting, the brake power will not be diminished as much as though it be made weaker. At the same time, if it be made stiffer, less braking power will be had in service applications, as the valve *x* will close earlier and shut out pressure sent from pipe *A* into pipe *B*. It would be impossible to successfully operate this system on a 50-car train on account of it having no quick action feature. See "Doctor Standard" elsewhere in this department. —Ed.]

The equalizing feature of the brake valve is here done away with, and we go back to a direct reduction. The gradual application of brakes is had by a long tapering groove connecting train line with second line and brake cylinders.

[Even this brake would be better off with an equalizing discharge brake valve. It seems so odd in these modern times to hear the abolition of the equalizing discharge feature spoken of as progressive. —Ed.]

The brake cylinder pressure hand on the triple air gage will give response to the engineer of his work, instead of equalizing reservoir reduction. The equalizing piston performs the work of an intelligent engineer. An intelligent engineer can give the very best returns with a three-way cock, especially when he has a flat rotary valve and a long tapering groove to make the direct reduction with.

[The contrary has been proven.—Ed.]

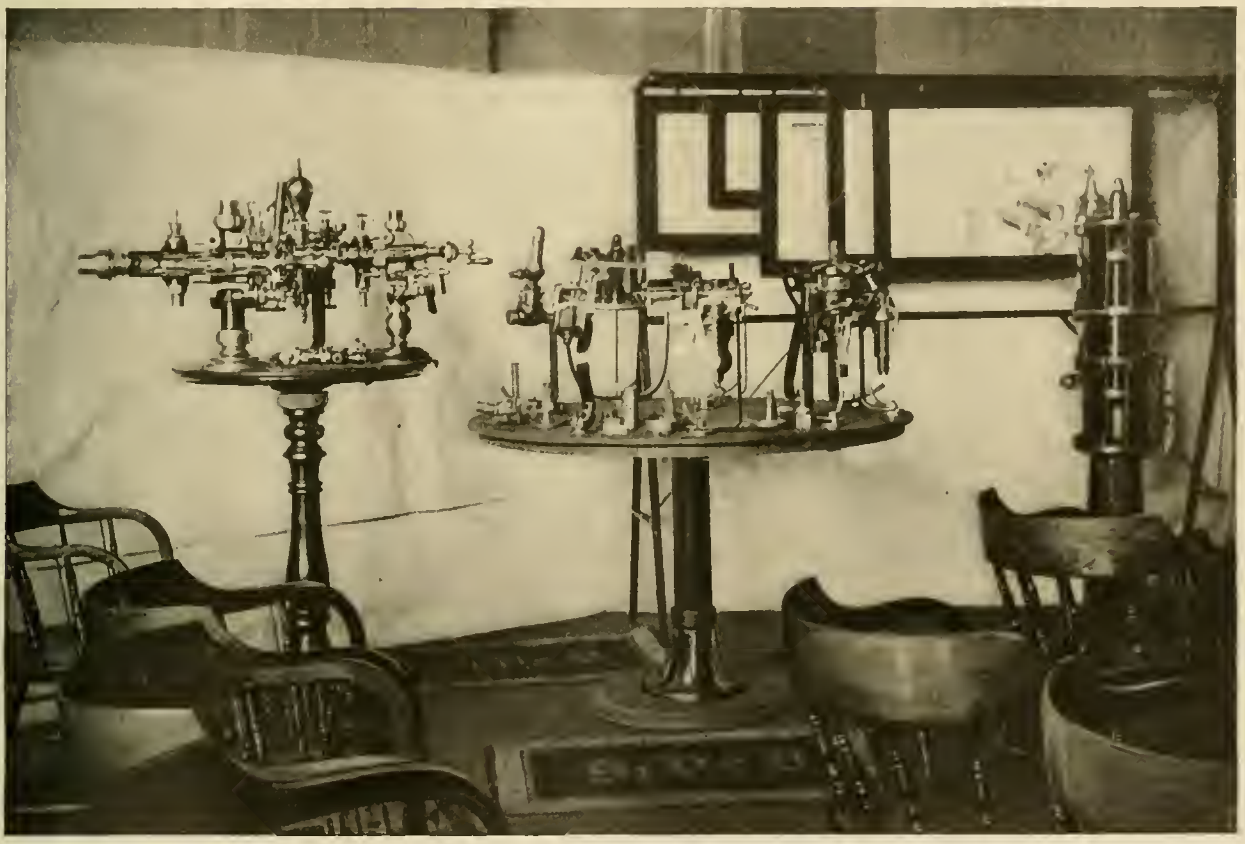
An engineer not well posted will cause a wave of air with an equalizing discharge valve, just the same as he will cause it with a three-way cock in a partial emergency application.

[The equalizing feature of the brake valve was not supplied with a view to preventing the engineer from doing wrong work, but was to furnish him means whereby he could do good work. The water glass and gage cocks are placed on a locomotive that the engineer may know how much water there is in the boiler, but will not prevent the water from getting below the crown sheet should the engineer become careless and neglectful.—Ed.]

As the engineer is governed solely by brake cylinder pressure to stop his train, he should, above all things, be aware of a packing leather leaking when it is so bad that it will leak off the brakes quick. In the first place the engineer watches his brake cylinder pressure hand and notes the pressure received from an application, and when he laps his valve he also notes what leak there is in the brake cylinder and second line by the brake cylinder pressure hand on the triple air gage when testing the brakes before starting out; and if such a condition existed as Mr. Best speaks of, it would be repaired or cut out, instead of the engineer starting out with the idea that he had five cars of air, when, in fact, he has only three or four, also saving the pump the trouble and expense of pumping air for an auxiliary reservoir that is only to be wasted through a bad packing. The engineer would know how the brake cylinders were holding pressure without taking someone's word for it.

[The use of a third hand on the air gage may have certain uses; but we gravely doubt it being an unmixed blessing. Again we doubt whether it would be watched closely. It is difficult to get certain engineers to watch the gage long enough to see that a proper initial reduction is made. Between giving necessary attention to operating the three-way cock to prevent kicking off head brakes, and watching the slowly accumulating brake cylinder pressure on the third gage, we wonder how much time he would have left for his other duties, and whether some night, when thus occupied, an indignant flagman might not throw a lantern through the cab window.—Ed.]

The second line would be the instigation



VIEW NO. 6—ST. PAUL & DULUTH AIR-BRAKE REPAIR AND INSTRUCTION ROOMS, ST. PAUL, MINN.

of having cars cut that would be detrimental to the service to have them cut in and would cause them to be reported for repairs.

You ask me if a good slack adjuster would not be a better way out of the difficulty of avoiding flat wheels and unequal pressure. With all present systems I would say an emphatic "yes," as they have no other way out of it.

[We made no reference to slid flat wheels in mentioning slack adjusters, although we are firm believers in slack adjusters as preventatives of wheel sliding. Our correspondent has not read our question rightly. We quote it from page 640, August number, as follows: "There is no doubt that to handle 50 air-braked cars, all having various piston travel, is a difficult task, and requires good work. But would not a good slack adjuster be the better way out of this difficulty?" All our comments herein are based on long trains.—Ed.]

A. M. WILLETT.

Camden, N. J.

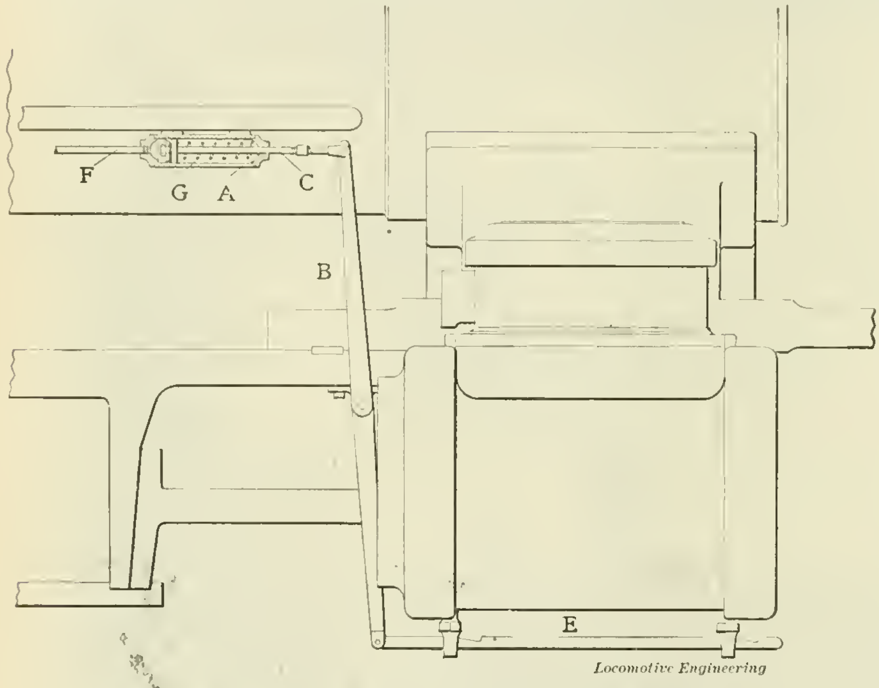
Apparatus for Handling Cylinder Cocks Pneumatically.

Editors:

I enclose herewith print of apparatus for handling cylinder cocks pneumatically; also an article describing same. We now have 140 engines equipped with this apparatus.

The air cylinder *A*, is placed underneath the running board, attached to back cylinder head casing, or may be located at any other convenient point. If placed underneath the running board, it may be connected to vertical cylinder cock lever, *B*, as shown on print. If secured to back cylinder head casing, piston *C* is coupled direct to cylinder cock rod, *E*. A quarter-inch pipe is run from cylinder *A* to an ordinary quarter-inch operating cock, such as is used on auxiliary reservoirs, this cock being located in the cab within easy reach of the engineman. The spring, *G*, operates to hold cylinder cocks open, and as it requires a pressure of say 65 pounds to compress spring, cylinder cocks will open should pressure in main reservoir fall below 65 pounds, thus notifying the engineman that the pressure in brake system is getting low, the reduction of pressure having taken place on account of pump stopping, leaks, or too frequent application of the brakes.

As the cylinder cocks open automatically when the pressure falls below 65 pounds, the risk of cylinders bursting during freezing weather is entirely obviated.



PNEUMATICALLY OPERATED CYLINDER COCKS.

It should also be noted that as the air pressure must be, say 65 pounds, before cylinder cock can be shut, and as most locomotive throttles leak more or less, hostlers cannot close the cylinder cocks and rush the engines out of the round house with cylinders full of water, and even if they should have the necessary air pressure to shut the cocks, the water in the steam cylinders will have practically been blown out while the engine is generating enough steam to pump the air pressure up to 65 pounds.

The patents on this apparatus are owned by J. W. Thomas, Jr., assistant general manager, and Otto Best, air brake inspector, Nashville, Chattanooga & St. Louis Railway.

J. W. THOMAS, JR.

Nashville, Tenn.

[Since the above communication was received, we learn that the Q. & C. Co. has secured the device described, and will henceforth handle it. Further information may be obtained by writing the Q. & C. Co., Chicago, Ill.—Ed.]

Would This be a Better Brake Than the Present Form.

Editors:

Further in reference to matter in your June number, you say: "Advocates of two-pipe air-brake systems are clearly in the wrong." Well, let us look at this for a moment, and suppose we are equipping the freight cars for a mountainous road that has long, heavy grades. In this equipment we put in a second line of pipes running through the train, caboose included. Now if we put a branch pipe on each car between this pipe and the auxiliary reservoir, this branch to have a common check valve intermediate between the reservoir and the pipe, the end of this pipe on the engine to be connected with the main reservoir, what would be the result? Manifestly the result would be that each auxiliary reservoir would be automatically supplied with air whenever the pressure therein was lowered. This would do away with retaining valves and require no especial attention of the engineer or brakemen. On all freight trains that I have been on the caboose brake is used to keep up the slack on turning grades, by connecting these two pipes in the caboose and using a valve similar to the engine valve, together with a hose connection between the hose of the caboose and the car next to it, this connection to have a check valve in its center, set so that the air in the main pipe could not pass to the caboose through it; then caboose brake could be manipulated by air same as by hand, and it is manifest that this connection between the cars could be made anywhere in the train that was desired, and it would not interfere with the engineer's having the use of all the brakes in the train when needed. He further says: "The single line system is good enough for us to handle until something better is developed. Then, we want that." Yes. Will Mr. Judd tell us how a better system is to be developed while the standard doctors say that nothing but their standard pills shall be tried? I for one would be glad to have such information.

BENJ W. SMITH.

Princeton, Ind.

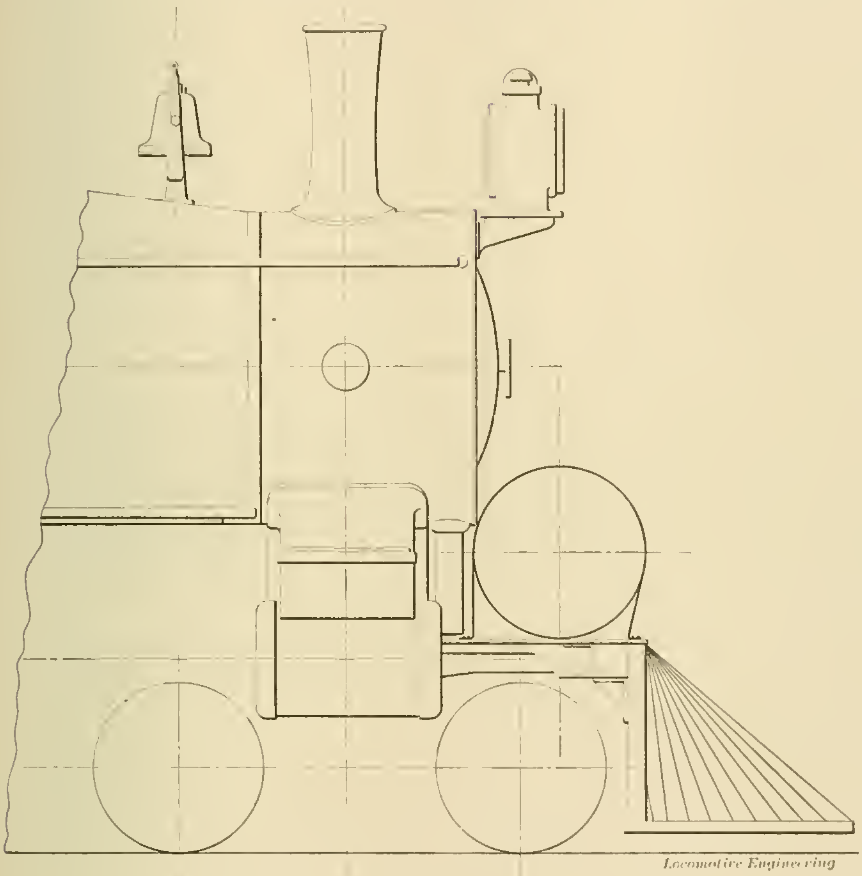
"Art" Loomis, the genial and efficient Lackawanna engineer, is noted, locally, for his humor and wit. A short time ago the boys in Scranton were discussing the good accomplished by the recent tour of the instruction car over the road. "Yes," said "Art," "it helped us a heap. We are now making stops with half the air we used to, and if the car had stayed another month, we would be making all stops with palm-leaf fans."

Better Location for Main Reservoirs.

Editors:

I have not, for some time past, seen in your paper any proposition for a new place in which to put the main reservoir. On most recently-built and up-to-date locomotives the boilers are situated high enough and the smoke-box is short enough to place the main drum as per the accompanying sketch.

The smoke-box and front end arrangement of the engine in the drawing are approximately the same as the Brooks eight-wheeler for the Illinois Central Railroad, illustrated in the January, 1887, number of "Locomotive Engineering," while the diameter of the main reservoir is 30 inches, as against 26½ inches in the Brooks engine, to say nothing about it being much longer.



SUGGESTED LOCATION FOR MAIN RESERVOIRS.

This idea would be specially applicable to Brooks engines of recent construction, which have no arch braces, and where as large a drum as would be wanted could be placed in front without inconvenience. If the drum interfered in any way with the cinder hopper a change in the operating of the latter could be easily effected so that it would cause no trouble. Of course, the scheme could not be well worked on narrow-gage engines, locomotives with low boilers, or those having the pony truck spring come up so high that there would be no room.

I object strongly to the position of the air pump on the Brooks passenger engine referred to above. True, it brings the center of gravity down and also makes the engine look neater, but it is a very unhandy place for an engineer to get at while his machine is running sixty or seventy miles an hour, as such engines often do.

Of course, air pumps are not supposed to get out of order, but once in a while, when not properly handled, they raise a kick, and this kick is sometimes raised on a part of the road that doesn't suit the engineer and a trouble ensues. Put the air pump where you can't help seeing it, and the engineer who is careful need not fear its getting out of order.

M. F. JUKES.

Whatcom, Wash.

Information Concerning the Marsh Recharging Device.

Editors:

In reply to Mr. Pratt's letter, published in August issue of "Locomotive Engineering," inquiring as to what objections there would be to lengthening the feed groove in the cylinder of piston triple so as to allow the reservoir to charge while piston is standing in normal position, in my pressure retaining triple, illustrated on page 307 in the April issue of your journal, I wish to say that his suggestion is absolutely necessary, and was represented in the drawing and described in the patent.

The pet cocks are placed on the triples to avoid the expense of the pipe to top of car, and its possibility of getting stopped up, and it is much easier to open or close them from the ground than it is from the top of the train when consisting of a mixture of flat and box cars.

The ordinary pressure retaining valves used at present are placed on top of the car so as to be accessible while the train is in motion, as they have to be turned down when an up-grade is encountered, which is not the case with my device.

A train can be handled much better on a level with my device in operation than at present, as the pressure admitted to the train pipe on level roads is not sufficient to cause the device to act on more than a few cars on the front of train, which has a tendency to hold the slack up when releasing the brake after making an application, and while the train is in motion and avoid the jerk from the delay in release of brakes on the rear of train.

G. W. MARSH,
Southern Pacific Railway.

Oakland, Cal.

Mr. Paul Synnestvedt, the well-known air-brake expert and writer on air-brake subjects, has recently finished a course in the North Western University Law School, and has branched out in business for himself. Henceforth he will devote his entire time to the patent business exclusively, and to that end he has opened up an office at 1234 Monadnock Block, Chicago, Ill. Mr. Synnestvedt has not lost his old-time interest in air brakes, and air-brake men will always find a welcome at his office.

The Air-Brake Department of "Locomotive Enginering" goes to press earlier than the other parts of the paper, and for that reason we are, each month, obliged to hold over correspondence which writers think has been sent in ample time, but which, in reality, has reached us at the eleventh hour. If writers wish their correspondence or answers to questions to appear in the following number, they should write us immediately upon reading their paper.

A patent on the "splice coupling," the short length of hose with an air-brake coupling on one end and a signal-line coupling on the other, has been granted a Mobile (Ala.) man. It is strange that a patent should be granted on an article which has been in general use so long as this one has.

The Air-Brake Men's Nashville proceedings contains the latest things in air brakes. Send us 50 cents for a paper-bound copy, or 75 cents for a leather-bound.

"Doctor Standard."

A DESCRIPTIVE SKETCH OF THE BURLINGTON BRAKE TRIALS.

On page 700, September number, a correspondent questions the wisdom of railroads in adopting a standard form of air brake, as he believes that in so doing they have deprived themselves of improvement which inventors might otherwise now give them. To energize a picture which he draws later, he portrays the railways as "Patients" and the M. C. B. brake committee as "Doctor Standard." In such picture we have "Patient Railroad" and "Doctor Standard."

"Doctor Standard" is a villain who compounds "standard pills," which, by some hook or crook unexplained, he inveigles "Patient Railroad" into swallowing, very much to the injury of that individual's good health. In some cases, it is given, these deadly pills have nearly sent "Patient Railroad" to kingdom come: and it is only by the skill of "Doctor Receiver" that "Patient Railroad" has been able to retain and enjoy the use of his breathing apparatus. We expressed our skepticism of the existence of this fellow with the Borgia instincts, and promised to tell in this number of another "Doctor Standard" of our acquaintance, a wise railway physician, and one keenly awake to his patients' interest. It is of this friend of railroads that we write the following true story:

About ten years ago, "Patient Railroad" called upon "Doctor Standard." "Doctor," said he, "air brakes on my passenger trains have done their work so well that I have decided to equip all my freight cars with them."

"Have you ever tried air brakes on freight cars?" asked the Doctor.

"Yes, on a few, and they seem to do as well there as on passenger cars. I have made up my mind to put air brakes on every freight car I own."

"Hold on," rejoined the Doctor. "Don't be so fast. This is a matter of great magnitude and of much importance, and I would therefore urge deliberation and caution. Upon how many freight cars have you operated air brakes continuously in one train?"

"Oh, on about 20 or 25 I guess, and they worked fine. No trouble whatever."

"Do you ever have more than that number in a train?"

"Oh, yes. Sometimes as many as 50, but if brakes will work satisfactorily on 25 cars they ought to work equally well on 50, shouldn't they?"

"I don't know about that," said the Doctor, "and neither do you. You are only guessing at it. I have a suggestion to make. Don't try to settle this question to-day. Let us both think it over to-night and compare notes to-morrow. Then we will perhaps be able to arrive at a more satisfactory conclusion as to what is best to do."

"Patient Railroad" agreed, and was on hand bright and early next morning with an exciting story of how a 25-car train of stock, every car braked, running at passenger train speed had covered 350 miles during the night. "Why," said he, "Burns, the big stock man, said it was the best stock run he ever had, and was so pleased with it that he wanted to sign a fat contract immediately, giving us his entire business in the future. The rival road has had this business heretofore. I tell you, Doctor, I haven't changed my mind on this subject a bit since our talk yesterday, and next week I shall begin equipping every car I have. The automatic air brake is all right."

"Perhaps it is, and I shouldn't blame you much for taking the step when such seductive reports are coming in," said the Doctor, "but there exists the same objection and unknown element that we discussed yesterday. You braked but 25 cars. What would have happened if there had been 40 or 50?"

"It would have been just the same."

"Possibly it would; but we don't know. Listen to what I have to offer. I confess that your high opinion of the air brake is justified; but there are at least two very important items to be thoroughly considered before you begin equipping all your cars with brakes. First, what will brakes do on freight trains of greater length? Second, is it not possible that a better brake may be invented by some fellow about the time you have half your cars equipped with this one? Again, you may favor one brake, and your neighbor prefer another kind. Tom, Dick and Harry would all have different brakes which would not interchange with each other. Do you follow me?"

"Yes, but——"

"Then when cars would get off the home line," proceeded the Doctor, not heeding the interruption, "they would be like an Irishman in Germany who couldn't talk German. Do you follow? Yes? Well, we would have a mess of it then, wouldn't we? Now I am coming to the point. What I would suggest is this: I will call together all my patients (the different railroads throughout the country) and advise them to take concerted action on the freight brake question. If they consent I shall invite all inventors of freight brakes to meet at some convenient point and hold a series of tests on the same scale that train transportation is now made. These inventors shall come and make practical running tests with long freight trains, and the one doing the highest grade of satisfactory work shall be given the entire business of supplying you all with freight brakes. What do you think of the scheme?"

"It is all right," replied Patient, "but that chap they call 'Automatic Air' has the only brake and will have a walk over. See if he don't."

"Seeing is believing," said the Doctor, "and we'll let it rest at that."

In response to "Doctor Standard's" invitation, the several brake inventors met with him to discuss the matter of brakes for freight trains. He addressed them something like this:

"Gentlemen, my patients, the railroads, have had such satisfactory experience with power brakes on passenger trains, that they now propose to apply them to freight trains also. As their advisor, I shall dissuade them from choosing a brake until after a series of competitive trials at least one brake shall have proven itself entirely satisfactory for my patients' use. This series of tests will be held on the C., B. & Q. Ry. tracks at Burlington, Ia., next July. You are all invited to compete. Each competitor shall bring 50 freight cars equipped with his brake. It may seem that a brake which does satisfactory work on 15, 20 or 25 cars will do equally well on 50 cars; but we don't know. We want to find out. Inasmuch that 50 car freight trains are now common we will require your brakes to work satisfactorily in service and emergency stops continuously on that number of cars. We don't want to make any mistakes."

The inventors listened attentively, and "Doctor Standard's" scheme was agreed upon.

At the appointed time five competitors were on hand, each with his 50-car train. There were also there numerous inventors with blue prints and sketches of brake systems which the owners of course thought were superior to all others; but "Doctor Standard's" uniform reply to all was to get their systems in substantial form on 50 cars. He argued that a brake on paper and a brake on 50 cars were two entirely different things.

Then began a series of tests which forms one of the most important epochs in the history of railroading. The famous Burlington brake trials were on. It was a battle royal. The running ground was soon strewn with broken brake beams, pulled out drawheads and other evidences of roughly handled trains. One after another of the competitors, upon seeing that his case was hopeless, withdrew from the contest, until only two remained. These two we will call "Automatic Air" and "Automatic Vacuum." Both struggled hard for the supremacy; but at the end of 19 days "Doctor Standard" closed the tests, and calling the inventors together, addressed them as follows:

"Gentlemen, these tests have been disappointing. None of you have done satisfactory work, owing to the violent shocks produced in stopping. Three of you have brake systems which look well on paper, but as practical train stopping devices are dead failures. 'Automatic Air' and 'Automatic Vacuum' have brakes that work very well on 25 cars or less, but on a greater number the violence of the shocks is increased in a greater ratio than the square of the number of cars added. You have knocked the loads through the ends of rear cars with your terrific shocks. Your brakes are not adapted to 50 car trains. A quicker brake is needed. Go home, improve your apparatus, and report here again next May, and we will continue the tests."

Of all the competitors, "Automatic Air" probably felt the keenest disappointment. Prior to these tests his brake had been looked upon as a perfect one. Now his was classed with the others, and all were declared faulty. He, with the other inventors, had been sent home in much the same manner as a class of school boys who didn't know their lessons.

"Patient Railroad," said "Doctor Standard," as they walked off the field together, "weren't those shocks on the rear cars terrific? Suppose that train had been 50 cars of Burns' stock, and Burns himself had been snoozing in the caboose when that first stop was made. What would have happened? You don't know? Well, I'll tell you. Mrs. Burns would have been a widow and would have had Burns' life insurance before Friday night, and the local butchers would have been cutting up the dead steers for the hides and tallow."

"I'll admit I was a trifle hasty," said Patient, a little sheepishly, "but we all have had our eyes opened by these tests. Who would have dreamed that you couldn't get the air out of the train-pipe at the engineer's brake valve fast enough to set the brakes evenly on all cars, instead of setting those on the head cars and causing the rear ones to smash into them with enough force to knock the ends out of the rear cars. I wonder what we will learn next year.'"

"I don't know," said the Doctor, "but all of these fellows recognize the fact that their brakes must set quicker, and I'll bet dollars to doughnuts that next year they will all come with electric appliances to their brakes."

The inventors returned to their homes, and began the work of improving their brakes for the next year's tests. They all recognized that their brakes were too slow, and that something would have to be done to shorten the time of application. "Automatic Air" sat in his den thinking something like this:

"I expected to win; but in failing to win I have not lost, for there was no winner. There will be another test next year, and it will be my one concentrated aim that I shall come off the winner. The problem to be solved is this: How shall the brakes on the first and last cars be made to more nearly approach simultaneous application?" The other inventors were each asking themselves the same very important question, and each one proceeded to work out the problem on the lines he thought would win.

The following May, "Doctor Standard" held another series of tests even more extensive and complete than the first one. There were again five competitors. The old rivals, "Automatic Air" and "Automatic Vacuum" were the only old ones.

Of the three new ones, a most formidable competitor was recognized in a clever stranger whom we will call "Electricity." Although he used compressed air as a braking force, he applied and released his brake with two separate valves, operated with electricity.

"Automatic Vacuum" had practically the same brake system he used in the first trials, with the addition of an electric attachment to the valve on each car for applying the brakes. He did not use electricity to release.

"Automatic Air" had made the greatest change in his apparatus. He used a new triple valve. Instead of reducing the pressure in the entire length of train-pipe by opening the engineer's valve, the reduction was started at the brake valve, and the first brake in applying, took into its cylinder a portion of the train-pipe pressure, thereby making a reduction which applied the following brake, and so on throughout the entire train. He performed his work entirely by compressed air and did not use electricity to either apply or release brakes as the other fellows did. He was soon dubbed "Quick Action," and carries that name to this day.

The remaining two new-comers withdrew early from the contest, leaving the battle to be fought out by these three Greeks.

"Doctor Standard" and "Patient Railroad" stood by and witnessed a more interesting and exciting contest than that of the year before. "Automatic Vacuum" made much shorter stops than he did in the preceding year's tests, and made them without any shock to the rear cars. "Electricity" made even shorter stops still, entirely devoid of shock, and released every brake on the 50 cars in a little over a second's time. "Quick Action" had improved wonderfully in one respect, but had retrograded fearfully in another. At 20 miles per hour, he stopped in 200 feet in 8 seconds, as against 350 feet in 17 seconds the year before; but the brilliant record was entirely spoiled by the terrific shock on the rear cars. A shock that gave a slideometer movement of 20 inches in the rear car was reckoned sufficient to knock down stock and shift lading; and "Quick Action" got the abnormal slideometer movement of 70 to 103 inches. This was appalling.

"Patient Railroad" shook his head and muttered something about every dog having his day, and then and there transferred his allegiance to the clever stranger, "Electricity."

"The old war horse has met his Waterloo in that clever stranger 'Electricity,'" said "Patient Railway" to "Doctor Standard."

"Don't be too hasty in your conclusion, my fickle friend," replied the Doctor. "Perhaps we don't know the man's resources."

"Quick Action" lost no time in receiving sympathy and explaining his defeat. "I'll use electricity, too," said he. And he did, and in a run at 20 miles per hour, with his Quick Action brakes electrically applied, he stopped his 50 car train in 160 feet, in 7 seconds time, without any shock whatever. Think of it. Less than five freight car lengths.

And so ended "Doctor Standard's" second series of brake trials, and it was his conviction that "the field for improvement was still open as wide as the year before, and that the only successful system of freight brakes was air brakes actuated by electricity." He called the inventors together and told them so.

"I don't believe it," muttered "Quick Action" to himself. "I will yet do the whole thing with air and without the aid of electricity. Electricity is a fine thing in its place, but its out of place on a freight train. It would be all right if freight trains were run in glass cases, and there was an electrician on every train and a repair shop in every caboose."

"Quick Action" went to work in earnest. "My scheme is all right," quoth he, as he worked away. "A snake's never dead 'till his tail's dead, and the tail don't die 'till sun-down. I'll win out yet."

And he did. History has it that out of the new valve which nearly lost "Quick Action" the second contest held by "Doctor Standard," he evolved the present efficient valve so well known to all of us. The length of stop has been reduced. He has beaten the shortest stops made by electrically applied brakes. He has cut down the time of application from 8 seconds to 2½ seconds. The slideometer movement has been reduced from 103 inches to a fraction of an inch.

His genius and courage are truly admirable; and it has been said of him that "such triumphs in mechanics are only achieved by those whose genius is of that supreme quality which enables a commander to snatch victory from defeat."

Knowing all this, it was no wonder then that "Doctor Standard" gave his permission to "Patient Railway" to equip every car he had with quick action automatic air brakes. It was no wonder he addressed "Quick Action" as follows:

"My friend, yours has been a hard fought and well earned victory. The prize is yours, and shall remain yours until some man shall evolve a better brake than yours, but he will wrest the laurels of victory from you only by winning them as you have won them.

"Again, my congratulations for a well deserved victory."

Here ends the story of our "Doctor Standard."

The Q. & C. Co., in securing the Thomas-Best pneumatic cylinder cock apparatus, has added another good device to its list of splendid specialties.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(101) B. R. L., Columbus, O., asks:

1. Are not the springs which hold the brake beams away, so the brake shoes don't rub the wheels, a bad thing when brakes are applied? 2. Don't they rob the wheels of a certain amount of braking power? 3. Don't cars which have no springs get more brake power than those which have springs. A.—1. Yes, and their use should be discontinued. A.—2. Yes. A.—3. Yes.

(102) H. T., Paducah, Ky., writes:

Has not the pull-up driver brake a greater tendency to compress springs and pull engine frame down on boxes than that of the push-down type? My friend claims no difference in this respect. Will you please decide and explain? A.—With the cam brake, the pull-up type has a greater tendency to compress springs, while the push-down type has the opposite tendency. With the former type, when the brake is applied, the tendency is to lessen the distance between the shoes and cylinder by the driving springs compressing. On the push-down, the tendency is to increase the distance. On the outside equalized type there is no difference so far as compression of springs is concerned, for the cylinder and fulcrum point are both on the frame, and there are no springs between them, as there are in the former case.

(103) J. P., Marshalltown, Ia., writes:

1. Where does the trouble lie in a N. Y. engineer's valve, plate No. 3, when it does not release? 2. The same in a D 8 Westinghouse valve? 3. What causes the driver and tender brakes to kick off when only a few cars of air are attached, no leaks on engine or tender, N. Y. equipment throughout? A.—1. The trouble hardly lies in the valve unless it refuses to release brakes at all times. In that event, it is barely possible that the inner parts are so disarranged as to prevent the supply valve from lifting. Just what part is disarranged must be determined by inspection. Should it refuse duty one time, and respond another time, the trouble is probably due to lack of excess pressure in the main reservoir. A.—2. Lack of excess pressure. A.—3. Leakage from main reservoir into train line, probably past packing leather in equalizing piston, or past supply valve.

(104) R. K. J., Kansas City, Mo., writes:

I have one of the latest Westinghouse brake valves, and every time I moved the handle past lap position the air would blow out of the little elbow in the bottom of the valve. I plugged the hole up, and now every time I set the brakes they go on in the emergency. I claim the triples don't work right, but the car inspector says they do. Which is right? A.—The car inspector. By plugging that elbow up, you prevented the brakes applying gradually, as now, in order to apply the brakes, you must move the handle to the emergency position, in which the triples are supposed to work in the emergency. Take the plug out and watch how the brakes set when you move the handle to the service position, which is the first shoulder past lap. They should apply gradually then, and in all probability will. That air that gets out there is the train pipe pressure, and should escape there when you are applying the brakes for an ordinary stop.

(105) H. O. B., Swanton, Vt., writes:

1. Does an 8-inch pump with receiving valves of the proper lift get a cylinder full of air at each stroke at whatever speed it may run? 2. Does a receiving valve with excessive lift get seated before the end of stroke is reached? 3. Is not the air supplied in a larger volume in a given time than the discharge can accommodate and cause it to heat? 4. How near the end of the stroke does a discharge valve lift when pumping against 90-pound pressure? A.—1. It is hardly probable that a pump running at its maximum speed gets a cylinder full of air at as high pressure as when running a little slower. Just where this most efficient point is, an indicator card of each particular pump alone will tell. A.—2. If the speed of the pump is slow, the receiving valve will seat and open several times, and will be indicated by the chattering sound. When pump runs fast, the valve will remain open entire stroke if packing rings are tight. This can be tested by holding the hand over the section inlets. A.—3. No. The heat is caused by compression. The air is hot before the discharge valve lifts. 4. Generally speaking, somewhere about the last eighth of stroke, but depends upon conditions.

(106) J. A. B., Knoxville, Tenn., writes:

I have had a great deal of trouble with quick-action triples blowing at the exhaust. Will you kindly tell me what will cause this, and if there is more than one cause, inform me how I can tell which it is? A.—There are several causes for this as follows: Defective slide valve, leak past the seat of the emergency valve, leak past the gasket between the triple and cylinder head, or auxiliary reservoir with freight cars, and a defective tube in the auxiliary reservoir of freight cars. To locate which particular trouble is the cause of the blow, first have the car fully charged up, then close the cut-out cock next the triple, and if the brake sets, it indicates that the trouble is due to leakage past the emergency valve, as that is a train-pipe leak. The blow will stop when the brake is applied with this test. If the brake does not set and the blow does not stop, next cut the car in again and have the brake applied in service application. If the blow continues after setting the brake, it is a positive indication that the trouble is due to a defective slide valve; if it stops, it may either be the gasket referred to or the defective tube in the auxiliary, which one can be located by examining the gasket.

Meeting of the Railway Signaling Club.

The Club of Railway Signal Engineers held their fall meeting in New York on September 14, 1897, at the Grand Union Hotel, with President Gillingham of the Illinois Central Railroad in the chair, and twenty-seven members loaded to the guards with the technics of their profession, out of a total membership of fifty-seven.

In his address the President expressed himself clearly on the line of action likely to give the best and most lasting results to those who were looking to their organization for the highest efficiency. Election of applicants to membership was followed by reports from numerous committees, among which was one on primary batteries, and others on different kinds of batteries, showing comparative cost of the several systems from an operative standpoint.

At the night session discussion was had on papers read at the previous meeting, embracing many devices recommended for use in connection with signaling. The members evinced a thorough understanding of the topics under discussion, as well as familiarity with parliamentary usage, and for a young association there is no question but that it will carve out a record for itself fully equal to that of the older railway organizations. Invitations were accepted to visit the National Switch and Signal Company at Easton, Pa., and also to view an electric plant at New Britain, Conn. The body has held its meetings in Chicago prior to this, but New York appears to have got in its baleful influence at this time, and left memories that will linger for many days.

Cautious, but a Little Behind Time.

Jimmy Montgomery was running second section of No. 13 and pulling a train of loaded coal dumps on a foggy night from Nowhere to Sumtown. Pretty soon he saw a red light through the fog and he hauled her over and whistled for brakes in a hurry. "Didn't think I was getting so close to the first section, must be running mighty slow," he remarked, as he slowed down and the red light disappeared.

Then he opened her cautiously and loafed along awhile for fear of getting into that caboose. A little more speed, and the first thing he knew, there was the red light again and the former circus was repeated.

This performance occurred three times before Montgomery found out that he had been carefully following the tail light of a canal boat in the canal beside the road, where the curves and fog made it almost impossible to tell where it was. This was a good many years ago, but Jimmy Montgomery hasn't heard the last of "running second section to a canal boat" yet.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

A Railroad Hospital Car.

The Long Island Railroad Company has placed in commission a car that stands unique in railway equipment, as will be understood by a reference to our half-tone and line engravings of a car, to be devoted exclusively to hospital service. The interior views show the operating room with the dreaded table, and the opposite end of the car containing the cots, of which there is room for nine. There are twenty-four cots in all, and they are constructed so as to be utilized as stretchers when necessary. It is the intention of the management to place the surplus of cots at convenient points on the line, so as to be in readiness in case of an emergency.

Lockers are in the operating room, built especially for the purpose of containing every appliance and convenience known to modern surgery—and they are full. A drop table at the side of the car opposite the lockers, and a heating boiler together with a combination water tank for drinking and washing water at the end of this room, constitute an arrangement for convenience not capable of improvement. The water details and the sink under the tanks are all copper, polished. The floor is entirely covered with heavy linoleum in one piece, an excellent article in a place requiring scrupulous neatness, since a hose can be turned on this interior of the car without working injury to the furnishings, when once the bedding is removed from the cots.

Besides the pains taken in a sanitary direction, cheerfulness is induced by the pure white of the interior, which is also varnished, imparting an atmosphere of comfort that is quite homelike. The car is a standard passenger coach transformed into its present shape by removing the seats and introducing the partition and two side doors, as shown in the line engraving which gives the dimensions of the rooms and shows the size and location of the lockers in the elevations and plan. The car was fitted up for its mission of mercy at the Morris Park shops, under the direction of Superintendent of Motive Power Prince, who has produced a hospital on wheels equal to any ordinary emergency.

This car is now ready for service, and is subject to the orders of Dr. J. F. Valentine, the chief surgeon of the Long Island Railroad, who, with his assistant surgeons will be with the car whenever accident on the line renders it necessary to hurry to the relief of the injured. Other roads have an efficient though costly hospital service, but there are none that can alleviate suffering any better, nor justify their cost any better than this one, that can be rushed to the scene of trouble at an instant's notice.

HOSPITAL CAR.

Safety Appliances on Locomotives and Cars.

A new order issued by the Interstate Commerce Commission evinces a disposition on the part of that body to get at the exact situation of things with reference to the application of automatic couplers and air brakes. There appears to be nothing in the order that conveys a ray of hope to those who have builded on an extension of time beyond the fateful January 1, 1898. The full text of the document is given below:

"The Commission having under consideration the Act of March 2, 1893, entitled 'An Act to promote the Safety of Employés and travelers upon railroads by compelling common carriers engaged in Interstate Commerce to equip their cars with automatic couplers and continuous brakes, and their locomotives with driving-wheel brakes, and for other purposes;' and deeming it necessary to have further information as to the progress made by carriers in equipping their cars and locomotives in conformity with said Act:

"It is ordered, That each common carrier engaged in the transportation of Interstate Commerce by railroad be requested to file with the Secretary of the Commission on or before the first day of October, 1897, a statement showing:

1. Total number of freight cars owned September 1, 1897.

2. Number of freight cars equipped with automatic couplers between April 1, 1896, and September 1, 1897, including type and kind of coupler used.

3. Number of freight cars equipped with power or train brakes, other than hand brakes, between April 1, 1896, and September 1, 1897, including kind of brake used.

4. Total number of locomotives owned September 1, 1897.

5. Number of locomotives equipped with power driving-wheel brakes between April 1, 1896, and September 1, 1897.

6. Number of freight cars, if any, purchased or built between April 1, 1896, and September 1, 1897, which are not equipped with automatic couplers.

7. Number of freight cars, if any, purchased or built between April 1, 1896, and September 1, 1897, which are not equipped with power or train brakes.

8. Number of locomotives, if any, purchased or built between April 1, 1896, and September 1, 1897, which are not equipped with power driving-wheel brakes.

9. Estimated percentage of total freight cars which will be equipped with automatic couplers by the first day of January, 1898.

10. Estimated percentage of total freight cars which will be equipped with power or train brakes by the first day of January, 1898."

The Standard Steel Platform.

The steel platform described in connection with the Great Northern coast train, illustrated in our September issue, had a familiar appearance; but we did not recognize in it, with the opportunity for inspection at our disposal, our old friend the Standard steel platform, manufactured by the Standard Coupler Company, who have equipped fifty of the Great Northern passenger cars with their platforms up to the present time.

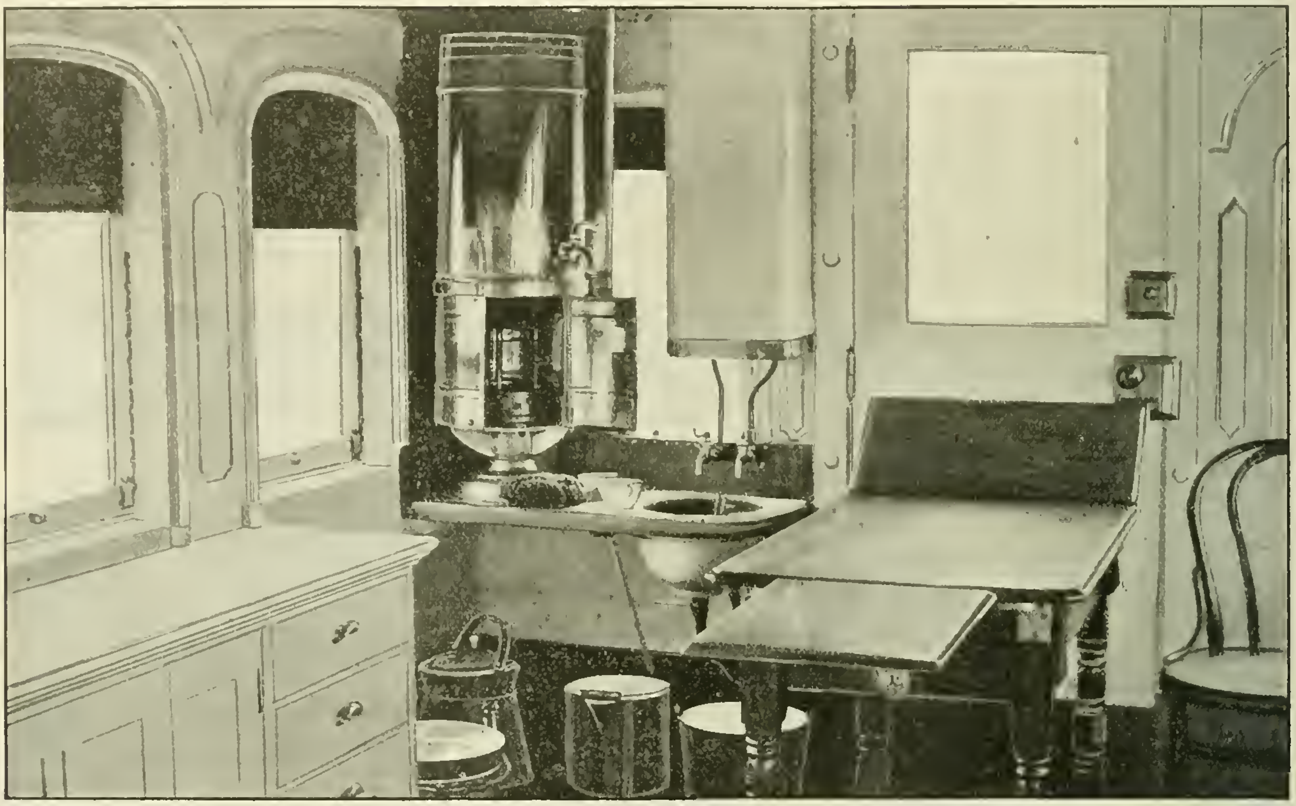
This platform has been adopted as standard by the Pullman Company, which fact, taken in connection with its use on no less than fifteen trunk lines, furnishes ample proof that it is a construction whose worth is meeting with a merited success. Metal in the framing of a platform, especially in that portion of it which is called upon to resist the shocks and stresses of the draft rigging, has engrossed the attention of the best mechanics for years, and the large following of the "Standard" indicates that the headwork devoted to the subject has not been barren of results.

Interchange Disputes.

At the July meeting of the Arbitration Committee, held in Chicago, several rough places were made smooth, among which were the cases of the Des Moines Railway Company versus Missouri-Pacific Railway Company in one instance, and the Lake Shore & Michigan Southern Railway versus Lake Erie & Western Railroad in the other.

In November, 1896, the Missouri-Pacific Railway Company rendered a bill against the Des Moines, Northern & Western Railroad Company for welding two truss rods on a D. M., N. & W. car, and attached a repair-card stub to the bill, giving as cause for repairs, "old truss rods broken." The bill was objected to by the D. M., N. & W. R. R. on the ground that when the car reached home, one of the truss rods was broken, clearly showing it to have been overheated in making the weld, and claiming that the charge should be made for but one truss rod repaired.

The M. P. Ry. Company insisted that the repairs were properly made, and showed from the record of the joint inspector between the road and the road over which the car left its line, that no defects existed on the car when it left the road, and said that it was not responsible for any damage that might have been done after the car left its line. The correspondence failing to settle the case, it was referred to the Arbitration Committee for decision, and in submitting it, the D. M., N. & W. R. R. stated that the



HOSPITAL CAR—OPERATING ROOM.

M.-P. Ry. claimed, and doubtless did weld two truss rods on the car in question, attaching repair card to cover same, and rendered bill, but when the car reached Des Moines, one of the truss rods was broken, showing that it was overheated in welding; that under the rules this is an owner's charge, but it contended that the owner has the right to insist on having the repairs made properly, which was not done in this case; consequently the bill should be for repairs of one truss rod, instead of two.

Decision—There is no evidence in the enclosed correspondence to show that the broken truss rod, when it arrived home, was broken where it had been welded by the M.-P. Ry.; but as it was claimed by the owning road that the iron was burnt, it may be inferred that the breakage was at the weld. The structure of iron that has been overheated is very similar to that of iron of inferior quality, having little or no fiber. The fact that the truss rod in question broke twice, and one other broke also, without evidence of unfair usage, would indicate that they were either too light or the iron of poor quality—most likely the latter; and as there was no question as to the responsibility of the car owner for repairs of parts similar to that in question which might fail under fair usage, it is the opinion of the committee that the bill of the Missouri-Pacific Railway is correct, and should be paid.

In December, 1896, the Lake Shore & Michigan Southern Railway Company rendered bills against the Lake Erie & Western Railroad Company for repairs to cars, attaching repair-card stubs to the bills. The bills were returned by the Lake Erie & Western road, objecting to the charges against twenty-one cars; the repair-card stubs giving as reason for removal, "hard spots" and "bright and hard spots," claiming that this was something new in journal-bearing defects, and there was nothing in the rules to justify it.

To this the L. S. & M. S. replied, that the terms shown on the back of the stubs giving the reasons for making the repairs are not as clear as they should be; that the terms do not, in reality, give the reasons for which the bearings were necessarily removed, but simply to give the condition of the bearings after the boxes run hot; that these hard and bright spots are caused by small particles of waste attaching themselves to the journal, and are carried around, getting in between the journal and bearing. The result is, they become hot, carbonize, and cause the oil to burn as it comes in contact with the carbonized spot. As there were no other parts of the running gear of the cars needing renewal, and as the boxes were given proper attention while in its possession, it maintains that the charges are proper, and refers to arbitration case 403 in support of its position, that it might have used the term "hot box" on the back of the stubs to show the reason for making the repairs, but preferred to state the actual condition of the bearings removed, which is conclusive that the journals were hot.

The L. E. & W. road replied, that the repair-card stub made no mention of the boxes running hot, and for that reason it objects to the bills; that it is inclined to believe that the brasses were removed without cause, and that the hard and bright spots were more imaginary than real. As for small particles of waste getting in between the journal and the bearing and causing hot boxes, that is an old and exploded idea; it had been repeatedly tried, without causing a hot box or injury to the bearing, and that the claims that they were removed on account of running hot is rather late, as this claim is not made until after the bills are disputed.

Not being able to reach an amicable settlement, the matter was referred, by mutual consent to the Arbitration Committee, who decided as follows:

Decision—The terms "hard spots," "bright spots," "copper spots," etc., express the general condition that a brass is found in after it has reached the hot stage. It has been ruled that hot boxes are not necessarily due to unfair usage. There is nothing submitted in the correspondence that warrants a conclusion that the brasses were not chargeable to the car owner. In the opinion of the committee, the bill of the Lake Shore & Michigan Southern Railway Company was correct, and should be paid.

The two cases cited above are fair samples of the trivial, not to say dishonest, practices resorted to, in some cases, to evade payment of a just bill. Such instances are not too rare, but they

HOSPITAL CAR—SECTION WITH COTS.

do not parade themselves as often as they once did, a spirit of fairness characterizing most of the interchange business, and the disposition to fight every bill slowly giving way to the precepts taught by the Golden Rule.

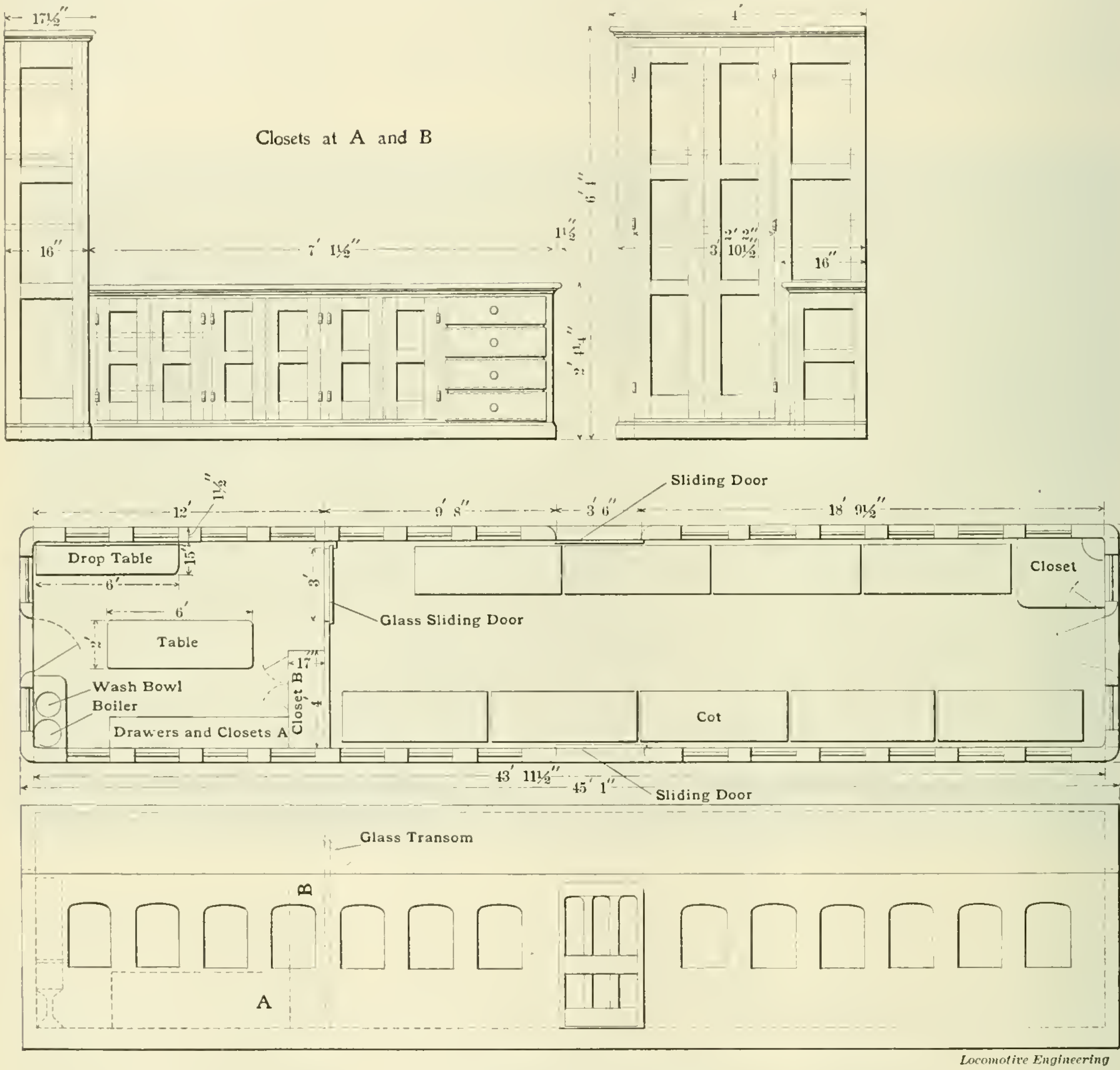
Yard Labor-Savers.

Proper facilities for loading of axles, scrap wheels, mounted wheels, etc., without the usual accompanying muscle stretching of a laboring gang is the exception rather than the rule in a shop yard, and on that account when once seen they leave a lasting impression on the mind of the observer if he takes an interest in affairs mechanical.

A case in point came under our notice at the Chicago car shops of the Chicago & Northwestern Railway, while browsing around that territory not long ago. Air, of course, was the means to the end, and this was used in cylinders let into the ground at points most convenient for handling the work. That for loading mounted wheels is situated centrally between the rails of the loading track, with car in front, and storage track at right angles with it. In loading, the wheels are rolled down to the lift, whose piston has on its top a saddle on which the wheels are rolled and afterwards lifted to a track on line with the car platform; by this means loading is easily and quickly accomplished.

For loading scrap or unmounted wheels, there are a pair of cylinders let into the ground about four feet from center to center, and a few feet from the side of the track. On the top of the air pistons which are made of 7-inch piping, there is a platform made of a size that will hold six or eight wheels, which, upon being raised to the level of the car floor by the air cylinders are loaded or unloaded with dispatch, and with none of that tired feeling experienced by the chain gang.

A like device is used for loading axles, with the difference that the platform, while standing at right angles with the track and car, is fitted with a series of cast-iron rollers, in sets of three placed end to end; the platform has one of the sets of rollers at each end, and each roller, which is independent and rolls on its own bearings has a concaved surface so that an axle will lie centrally in its place when once on the rollers. The platform, it is thus seen, will hold three axles at once, and being at the track level it is easily loaded, for the reason that the axles are laid on supports having an incline toward the lift, gravity carrying them there when the holding blocks are freed. When the platform receives its load, air is admitted to the cylinders and the load is elevated to the level of the car floor, onto which a slight push is sufficient to send the axles. If time saved were the only consideration, these labor savers would prove a boon to any shop.



HOSPITAL CAR—DETAILS.

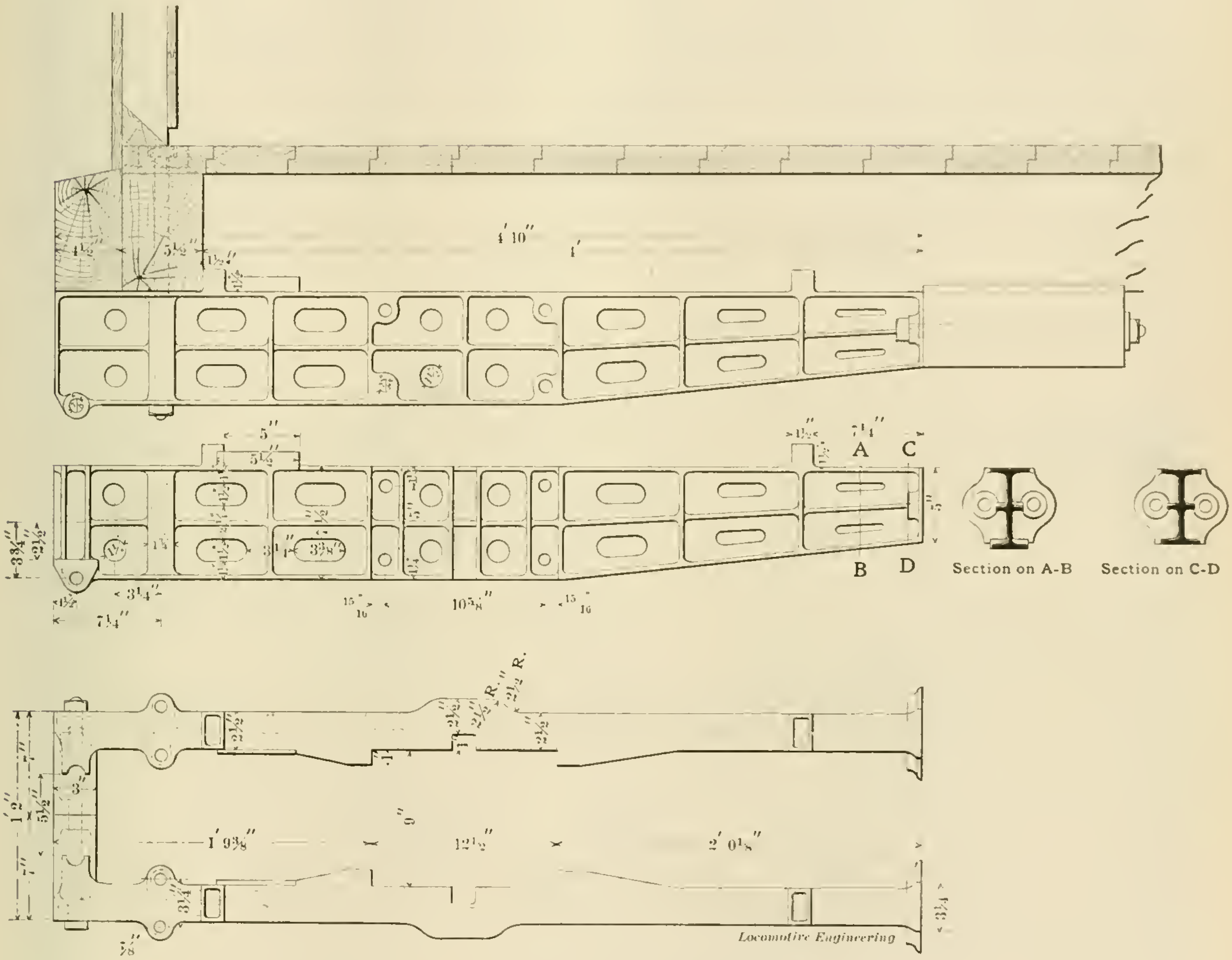
Malleable Draft Irons.

Wooden draft timbers have reached the limit of their power to vex and harass Master Mechanic Tonge, of the Minneapolis & St. Louis Railroad. They are to be supplanted by the malleable construction shown herewith, which was devised by Mr. Child, the head of the car department, who was prepared, by an annoying experience in the maintenance of wooden draft rigs, to follow the Scriptural injunction, "If thine eye offend thee, pluck it out." Substituting draft timbers for the organ of vision, he is now engaged in the eliminating process, and hopes to be forever rid of that terror of the repair track—the wooden draft timber.

The new arrangement has the metal distributed with the object of securing the required strength with the least weight, and is therefore not calculated to put the mind of the mechanical observer into a train of painful reflections. It is designed for the Butler draft appliances, and the plan view shows how well adapted are the metal members for making a solid job, the draft springs being boxed in securely between the shoulders and bolted laterally in the usual way. There are only two vertical bolts in each member, and those are at the end sill—a fact worthy of more than passing note, when compared with the old practice of putting in from six to eight 7/8-inch bolts, 18 inches long, between the end sills and body bolster. Two horizontal bolts pass through the flanges and bolster at the rear end, thus making four bolts do the work of eight.

Two lugs are cast on the upper face, and are let into the center sills; the forward lug abutting against the inside face of the end sill. In furtherance of the self-contained idea, the draw-bar is carried at the front on an extension cast on the underside, one half on each member, and a bolt ties the whole thing firmly. Chafing lugs for the sides of the draw-bar are also cast on, and the absence of the carrier iron and chafing lugs with their bolts constitutes another strong point in the lessening of parts to take care of. These castings weigh 400 pounds per car, while oak draft timbers, which they replace, weigh 312 pounds; but the reduction in parts due to the metal members makes a difference of 132 pounds per car in favor of the malleable members, a fact that may attract the attention of those engaged in solving the dead-weight problem.

The Chicago Great Western Railway shops, at St. Paul, have been working double time for a long period of time, employing two sets of men. This has been made compulsory by reason of the lack of facilities and shop room. The new shops projected at Oelwein, Iowa, are designed on a scale of liberality that, when completed, will be equal to all demands likely to be made on their capacity.



MALLEABLE DRAFT IRONS.

The Black Diamond's Fast Run.

When Engineer William Owens, with engine 667, took the Black Diamond Express at Sayre, on September 8th, it was fifty-one minutes late, but he pulled into Buffalo, a distance of 180 miles, only eighteen minutes behind time.

The time was two hours and fifty-six minutes (176 minutes), including two stops, one of five, the other of four minutes. This leaves 167 minutes actual running time for the 189 miles, which is remarkably good running.

FIFTH CONVENTION OF TRAVELING ENGINEERS' ASSOCIATION.

Traveling Engineers' Fifth Annual Convention.

The fifth annual meeting of the Traveling Engineers' Association convened at the Chicago Beach Hotel, Chicago, Ill., Tuesday morning, September 14th, President Conger in the chair.

The Committee of Arrangements, of which Mr. R. D. Davis, of the Illinois Central Railroad, was Chairman, were particularly fortunate in being able to secure such elegant accommodations as are afforded at the Chicago Beach, the hotel being located on the immediate shore of Lake Michigan, some six miles from the business center of the city, and within convenient reach of the latter, and incident to the frequent and rapid service afforded by the fast suburban trains of the Illinois Central Railroad.

The convention was called to order at 9:50 A. M., the association being well represented in numbers. Quite a contingent of the members were accompanied by ladies. Following a few preliminaries the president introduced Rev. Mr. Herst, who offered an eloquent invocation.

Corporation Counsel Thornton, in behalf of Mayor Harrison, then addressed the convention, extending to the members a hearty welcome in behalf of the city, and among other things stating that he had not the keys to the city with him, but that any of them could be procured at the city hall.

President Conger replied in his usual vein, and then announced that the convention was formally open for the dispatch of business.

In his opening address the president stated that the growth of the association membership during the past year had been of a substantial character. In four years the membership had increased from 107 to 162, and he ventured the expectation that the present meeting would close with 200 members on the roll.

Four members had died during the year: P. J. Karney, charter member; George Royal, Sr., W. H. Garney and D. L. Barnes, associate member.

The financial condition of the association was much better than a year ago.

The president advocated the furnishing of two copies of the proceedings to each member, the extra copy to be used as a means of increasing membership.

A joint meeting with the Association of Air Brake Men had not yet been consummated.

The economical operation of locomotives has progressed mostly from the adoption of the tonnage basis. Formerly engines were loaded to full capacity, but a tonnage basis gives increased results.

The agitation of replacing locomotives with motors during the past four years had not materialized to much extent. The results of the coal strike were referred to, and the address was replete with good suggestions.

Secretary Thompson's report followed, the showing being that the association was in better financial condition at present than at any time during the past three years.

The president announced that no report would be submitted by Treasurer McBain, as no funds had passed through his hands during the year; it having been disbursed as fast as received.

Messrs. C. P. Cass, J. A. Gibson and J. R. Bildon were elected as Auditing Committee.

There being no unfinished business, the convention proceeded to the reading of papers. The first was on the subject, "The Preparation of Coal for Use on Locomotives, and Proper Tools to be Furnished," by Chairman McBain.

Following the reading of the paper, a discussion was indulged in by Messrs. McBain, Burke, O'Neill, Thompson, Stack, Gould, Hammer, Malone, Angus Sinclair, Scott and others, following which a motion was made and carried, that the recommendations of the committee be received as the sense of the convention.

A communication was read from Superintendent M. P. Quayle, C. & N. W. Ry., inviting the members to visit the locomotive-testing plant at West Chicago, and tendering a special train to carry the members to the shops. The invitation was unanimously accepted, and Thursday P. M. was designated as the time for making the visit.

The Auditing Committee made report that books and accounts had been examined and found correct. Report received and placed on file.

Tuesday, P. M.

Session opened at 1:45 with the reading of a paper by Chairman Donovan, entitled "Is the Brick Arch an Economical Adjunct to a Locomotive?" The conclusions of the committee were, that "from experience, they were decidedly of the opinion that the advantages of the brick arch by far outweigh the disadvantages. and believe that the success or failure of the brick arch is largely dependent on the manner in which it is applied, and the conditions under which it is used."

In the discussion which followed, Mr. McBain stated that placing the brick arch against the flue sheet had given decidedly good results on his road, both as to free steaming and preventing lower flues from leaking.

Angus Sinclair gave some very interesting reminiscences regarding the early introduction of brick arches in British locomotives, arches at that time being intended only as a smoke preventive, and he declared that the brick arch was the only survivor of alleged smoke burners.

Brick arches were found to be a requisite in the small engines with which he was familiar, and in his early railroad experience he had found brick arches a most economical adjunct when properly arranged.

Sanford Keeler had observed an economy of fuel of 20 per cent. with the brick arch.

Geo. Taylorson had observed no good results from the use of brick arches in freight engines.

Different devices for supporting brick arches were discussed, but no particular method was advanced as being superior to others.

The consensus of opinion was, that brick arches give both economy in fuel and prevent smoke; much, however, depending on the firing being intelligently done.

Mr. Sinclair remarked that no reference had been made to the admitting of air above the fire. An ideal smoke preventive is the brick arch, baffle plate over the firebox door, and appliances for regulating the admittance of air.

Mr. Hedendahl read a paper entitled "Repairs and Adjustment of Air Brake Equipment while on the Road."

Mr. Scott advocated the use of dry graphite for hot air cylinders of air pumps.

Mr. Hedendahl deprecated its use, owing to tendency of clogging valves and passages.

Various methods were advanced for locating bad leaks in train line, such as bursted hose, when on the road and best practice for correction.

A communication was read from Superintendent of Machinery Renshaw, inviting the members to visit the extensive shops of the Illinois Central Railroad at Burnside, Ill., and tendering a special train at the pleasure of the members. The invitation was accepted with thanks, and the convention adjourned. Many of the members, with their ladies, on invitation, attended the performance at the Masonic Temple roof garden, this building being one of the famous "sky scrapers" of Chicago, the entertainment taking place 250 feet above the street.

Convention called to order at 9:30 Wednesday morning and unfinished discussion on air brake paper taken up, and after a somewhat desultory discussion the subject was closed.

A committee to present subjects for 1898 was appointed, consisting of Messrs. Scott, Burke and Anthony.

At this juncture it was moved and carried that a committee on amendment of rules and by-laws be appointed.

The report on the Brown system of discipline being called for Chairman Brown remarked that owing to a lack of replies to the circulars sent out and consequent lack of information on the subject, he suggested the propriety of deferring the report until next year.

President Conger urged the reading of the paper, which was done.

Following a reading of the paper several letters were read from Mr. G. R. Brown and other railroad officials, each commenting on the good, practical working of the Brown system.

A discussion of the paper was indulged in, many members speaking, and while some of the thirty-five roads which have adopted the system, use it in a somewhat modified form, the very general sentiment of the members present was that the system was a success wherever its merits had been fairly tested, inasmuch as it was equitable to the employé, creates better men, and consequent improvement of service.

The sense of the convention was taken, and the Brown system, without suspension, was unanimously approved. At this point discussion closed.

Mr. I. H. Brown next read a paper, the subject of which was "The Operation of Lubricators Under High Steam Pressure, and Other Appliances for Oiling Cylinders and Valves."

The paper and discussion which followed brought out much interesting information.

It was evidently proven that a steam pipe of sufficient bore to maintain practically boiler pressure in the lubricator was requisite; that the oil pipes leading from lubricator to steam chests, when of full size opening throughout their length, destroyed the movement of the oil towards the steam chests, particularly with high boiler pressure and valves working at short cut-off. Tippett and other styles of attachments used in connection with the various designs of lubricators had largely remedied the trouble of back pressure in the oil pipes, but while progress had been made in this direction, perfection had not yet been reached.

A committee on revision of the Constitution and By-Laws was appointed, consisting of Messrs. Thompson, Main and Donovan.

The session was continued until 1 P. M., when adjournment for the day was made, to give those desiring an opportunity to tour the parks and boulevards. Members and their ladies in large numbers boarded the tally-ho coaches at 3 P. M., drove to the Columbian Museum, where group photographs of the party were taken. A ride through the parks was next in order, the festivities of the day concluding with a steamboat ride on Lake Michigan.

Thursday's session opened at 9:25 A. M., the former attendance being largely augmented by the arrival of belated members. The first order of business was the reading of a paper entitled "How Should a Locomotive be Operated to Secure the Most Economical Use of Steam and Fuel, Speed and Weight of Train to be considered."

The paper treated the subject under three principal heads: 1st. The skillful manipulation of the different valves and levers that serve to control this force, that it may be used to its utmost capacity, and its power also be tempered when the conditions so demand.

2d. Skillful firing.

3d. Education of enginemen.

In the answers to the circulars sent out by the committee and received from thirty members, all but two advocated throttling the steam, rather than very short cut-off.

A long and somewhat exhaustive discussion followed the reading of the paper and the general impression seemed to prevail that a cut-off of less than 25 per cent. of full stroke was not good practice.

In reply to a question Mr. J. H. Setchel, of the Pittsburgh Locomotive Works, stated that with compound locomotives 10 to 14 inches cut-off gives best results.

Mr. John Mackenzie addressed the convention most entertainingly, his talk being replete with witticisms interspersed with sound practical information. He thought that skillful firing as well as manipulating the throttle and reverse lever had a considerable bearing on coal consumption. Superintendents and train dispatchers keeping trains on time was also a very considerable factor in affording economy of fuel, oil and engine repairs.

Mr. Angus Sinclair admitted that from his earlier mechanical education he had been imbued with the idea that shorter cut-off gave greater economy in fuel, but he had since become convinced that he was mistaken. Messrs. Brown (C. & O.), Malone, Burke, McBain, Cass and others participated in the discussion. The consideration of the subject matter of the paper was brought to a close by the adoption of a resolution by Mr. C. P. Cass as follows:

"Resolved, That in view of the fact that so many conditions of service, classes of engines, quality of feed-water, etc., govern the economical handling of locomotives, that it would be unwise and inexpedient on the part of the traveling engineers to lay down any hard and fast rule governing the handling of the engine. It is believed that the matter can safely be left to the judgment of the intelligent enginemen of American railroads."

Mr. Kneass gave a very instructive talk on injectors, particularly the Sellers, meantime answering numerous questions pertaining to their construction, operation and maintenance, which brought out much information of a generally obscure character.

The social feature of the day was a visit to the West Chicago shops of the Chicago & Northwestern Railway, where a locomotive had been mounted on the testing machine for the special purpose of giving the traveling engineers an opportunity of witnessing its operation. The ladies, chaperoned by that worthy successor of the late George Royal, Sr., Mr. F. D. Fenn, paid a visit to the Art Institute and in the evening many attended the theatre.

The final day of the convention opened with the reading of a paper on "The Care, Maintenance and Economical Operating of Metallic Packing."

The conclusions of the committee were that metallic packing for piston rods, valve stems and air pumps is beyond question, as to durability and economy a very satisfactory device, it requiring only a proper composition, design, application and maintenance.

A somewhat lengthy discussion developed no objections to metallic packing, all being much in favor of it for all conditions of service, and the findings of the committee were adopted as read.

At this point of the proceedings the discussion on injectors was resumed, Keeler, Hedendahl, Kneass and others taking part, and the subject provoked much interest. The reading of papers was concluded with one under the caption "Duties of Engine and Trainmen in Testing Air Brake Equipment on Engines and Trains."

In the discussion of the paper the consensus of opinion was that the rules governing these tests were all right, but that in the hurry, often incident to train movement, they were frequently not properly observed. In introducing the subject of joint meeting of the Traveling Engineers and Air Brake Associations President Conger stated that the Executive Committee favored dropping the subject.

F. M. Nellis, in giving a history of the negotiations between the two associations, remarked that he first favored, but now opposed, a joint meeting, as both were self-supporting and from the fact that the association meeting last year had decidedly the worst of it. A motion made that "the sense of this convention be that no further action be taken for joint meeting" was carried, which precluded, for the present, at least, the bringing together of the two associations. The committee on subjects for the 1898 convention presented the following:

1st. Lubrication of Locomotives. Best method of reducing hot bearings to a minimum with the least amount of oil.

2d. The use of water on hot bearings of engines and tenders. Is it advisable and to what extent used?

3d. How can the traveling engineer best instruct and assist the fireman in the economical firing of the engine?

4th. How can the consumption of coal be reduced per ton mile?

5th. Does the location of track and station signals in any way affect the safe and economical operation of locomotives?

6th. Is the Brown system, as it was originally instituted, your idea of a method of discipline without punishment? If not, what would you consider the best modification?

7th. What is the best method to be pursued by traveling engineers in giving air brake instruction while on the road?

8th. Uniformity of cab fittings and their arrangement, with a view of accessibility and utility.

The committee was empowered to designate which of these subjects, not more than five, to be open for discussion.

Resolutions of condolence were read on the death of W. H. Gurney and George Royal.

Changes were recommended in the Constitution and By-Laws as follows:

Time of meeting changed from second Tuesday in September to either April, May or October, the month to be decided by letter ballot, the Executive Committee being empowered to set the day. Honorary memberships, not to exceed fifteen in number, for members who may be promoted to higher official position, the dues to be $1 per year.

President of the association to be chairman of Executive Committee.

In the event of death or resignation of any officer of the association the Executive Committee to make appointment for balance of year.

Office of third vice-president to be created.

These resolutions were adopted as a whole.

Numerous letters were read from mayors and prominent clubs of various places containing inducements and cordial invitations for the convention to meet in their respective cities.

Balloting resulted in Buffalo, N. Y., being chosen as the place for the 1898 meeting.

The following are the officers chosen for the coming year: President, D. R. McBain; first vice-president, W. C. Hamer; second vice-president, W. R. Scott; third vice-president, M. W. Burke; secretary, W. O. Thompson; treasurer, W. R. Johnson; member Executive Committee, C. B. Conger.

A committee of three was appointed to draft resolutions expressing the appreciation of the association on the able and faithful manner in which the retiring president had performed the duties of the office.

A pleasing episode in the closing hour of the convention was the presentation to each member of the committee of arrangements of a token of esteem in recognition of the energy and labor they had performed in catering to the comfort and entertainment of the members.

Adjournment followed, to meet at such time in Buffalo as the Executive Committee may elect.

NOTES.

The supply men were in nowise conspicuous by their absence.

Among the exhibits were H. W. Johns Manufacturing Co., asbestos lagging and vulcabeston packing; Munson's safety boiler checks, safety water gage cocks and safety angle-cocks; Hancock inspirator, locomotive hose strainer, check valve and Hancock ejector; Stannard & White, engineers' specialties; Detroit lubricator; Metropolitan injector; Ashcroft steam gage and Ashton pop valve.

The convention was a success from start to finish, the members at all times being ready to take the floor and discuss the question at issue without compelling the chair to prod them with his vocal goad stick.

The New York Railroad Club.

The opening meeting of the fall and winter series of the New York Railroad Club was held at the rooms of the American Society of Mechanical Engineers, their usual place of assembly, on Thursday evening, September 16th. After the general routine of business had been transacted, a paper on lubrication was read by Mr. Miller, the President of the Galena Oil Company, who worked in the parable of the wise and foolish virgins with their lamps, in a very neat parallel, in which the failure of the ladies to have a proper oil supply was likened to the policy of railroads that neglected to furnish lubricating material for their equipment.

Rollers were aptly taken to exemplify the action of a lubricant, and an iron roller was compared to one of soft wood in its ability to hold up a load, and by its resistance to compression, to reduce resistance; these similes were taken to illustrate the value of oily rollers or globules in keeping down frictional resistance, and pointing the moral that the soft roller was like unto the improper lubricant. Reference was made to the policy of the Galena Oil Company to urge railroads to make miles to the pint of oil, and not preach economy in the use thereof, as the miles would take care of the economy. An analogy between a horse fed on bran, and therefore with not sufficient strength to pull a load, and a locomotive improperly lubricated, was made by the speaker, with the view of making his position plain, that too much economy in the use of oil would be too likely to have the opposite effect in the cost of transportation.

In the discussion that followed, Mr. Forney wanted to know why oil lubricates, and how we know that oil is globular and not hexagonal, or "cubular," as he quoted some other party as saying, and he asked Mr. Miller to explain how high a steam temperature the oils of today would stand, and also why oil would lubricate and water would not. Mr. Miller answered the query by saying that the microscope revealed the globules in oil, and the position was further substantiated by the fact that oil became thinner by expansion when heated; all matter, he said, was globular in form—all matter, except poor oil.

The causes of copper spots on journal bearings were discussed, with few resulting facts that could throw any light on the subject or furnish any excuse for their existence. Mr. Mendenhall had heard that they were due to chemical action purely, and had nothing whatever in common with poor brass, as had been advanced as a reason for them by some members during the discussion. The meeting was fully up to the standard, in point of attendance; but, while all of the war horses were present, there was an evident indisposition to get into the fray so early in the season.

Roundhouse Conveniences.

In order to facilitate roundhouse repairs, Supt. of Motive Power Quayle of the Chicago & Northwestern Railway has installed a planer, two lathes, a drill press and a bolt cutter in a building adjacent to the roundhouse and also convenient to power, for the use of the roundhouse force. The move was made with the view of reducing the time lost in doing roundhouse work, by traversing the space between the roundhouse and machine shop, and also cutting out the long waits for work at machine tools.

The move is new only in the revival of a practice that was in vogue when many of us were younger and looking for the shop where the pay schedule was the highest. It implies a leaning towards the good old time when the all-round mechanic was a power in the shop; when the machinist was not a specialist, but had to earn his title of a "good man" by an exhibition of his ability to handle a job through all phases of manipulation in its journey from the smiths' shop to the final lathe, drill, planer or bench, to the final assembly in place on the engine. We had supposed that there were too few mechanics in possession of the required talent, to inaugurate such a move at this time, and the fact they are there speaks well for the shop that fosters that kind of labor and can keep it from emigrating. There are not any too many of them made these days.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(74) H. T., Paducah, Ky., asks:

Will you please answer the following? If after an engine is equalized, and her valves set, it becomes necessary to raise the engine 1½ or 2 inches at the trucks and boxes, will it not slightly affect the valve motion? A.—The effect of raising the engine and, with it, the links and hangers, will be inappreciable with eccentric rods of average length; but the tendency will be in the direction of an increase of lead.

(75) J. H. M., Savage, W. Va., writes:

If a car axle is slightly bent, or a wheel not bored true, what would you consider an allowable difference between the flanges at the closest and widest points, consistent with safety? A.—It is the practice in many well-regulated shops to leave wheels in service that show a difference of 1-16 inch between two opposite points in the flange of a wheel with reference to the rail, making that amount the limit; we have, however, known wheels to run with ⅛-inch difference at those points. The better plan for safety is to keep the axles straight and bore the wheels true; no invitations to disaster should be allowed in wheel mounting.

(76) S. C. B., San Diego, Cal., writes:

I find myself in want of a tool that will enable me to put in staybolts in a firebox, behind the frame, without disturbing the latter. To take down a frame is an expensive job with us, and I know of no better way to find such a tool than through the columns of your paper. If you will kindly bear this question in mind in your next issue, it will be regarded as a special favor. A.—A tool for cutting out broken staybolts from the inside of the firebox, is shown and described on page 59 of our January, 1897, issue. This tool, a remarkably efficient one, was devised by Mr. C. E. Turner, superintendent of motive power of the Buffalo, Rochester & Pittsburg Railway, Rochester, N. Y.

(77) J. C. B., Marietta, O., writes:

We have had an argument as to whether a sight-feed cylinder lubricator feeds oil to the cylinders or not, while the engine is working steam full pressure. I say it does; others say it does not. Can you set us right in the matter? A.—It is very generally understood that a lubricator will not work properly when the engine is working under full throttle. The reason for its failure to deliver oil to the cylinders with a uniform or constant feed, is, that the steam-chest pressure overcomes the flow of oil and holds it back in the delivery pipes; this conclusion is reached from the fact that when the engine is run with a partly closed throttle, thus reducing the steam-chest pressure to a point nearing that on the lubricator, the cylinders are lubricated more or less efficiently. For more extended information see "Proceedings of the Traveling Engineers" for 1896, and also "The Lubricator Question," in this issue.

(78) H. A. D., Boston, Mass., writes:

I have one of your train resistance computers, but am unable to find from it the weight of train an engine can haul at slow speeds on a level—say, at ten miles an hour—when the draw-bar pull equals 20,000 pounds, or 10 tons. The printed instructions are plain enough, but the resistance in pounds per ton, as given by the computer, does not seem to show on the revolving disk when the latter is placed in accordance with the printed directions; that is, the resistance is much too large for agreement with that found on the computer. Please explain how to take the readings for the stated conditions. A.—First, find the pounds resistance per ton of load by setting the train speed in miles per hour, opposite the line marked level, and find under the radial edge 5 pounds per ton of load. Second, set the draw-bar pull, 10 tons, opposite the arrow marked "total resistance in tons," reading the graduations of pounds resistance per ton of load as tons of draw-bar pull for this purpose. We may now read any multiple of five—say, 50—on the disk, and opposite, on the graduations of weight to be hauled, will be found 400, which multiplied by 10, since 50 was ten times the actual resistance, we have 4,000 tons as the hauling capacity of the engine. The same result will be found by setting 1 on the disk to represent 10, opposite the arrow of total resistance in tons, when the actual resistance of 5 pounds will appear in its proper place against 400 tons of weight to be hauled; but since 1 ton was used to represent 10 tons, the reading of weight to be hauled must be multiplied by 10, and 4,000 tons is again obtained.

Part 7 of "Easy Lessons in Mechanical Drawing and Machine Design," by J. G. A. Meyer, has just been received, and it should be of great interest to engineers of all kinds, both locomotive and stationary. It treats of the slide valve in Mr. Meyer's painstaking way, which makes every detail clear to the student. His valve diagram, which is a modification of the one used by Professor MacCord, is the simplest and clearest we have seen, and will be appreciated by many to whom the Zeuner and other complicated diagrams are mysteries. It seems to grow better with each issue. They are published by the Arnold Publishing Company, 16 Thomas street, New York.

Lard Oil or Drilling Compounds.

BY R. E. MARKS.

The purchasing agent of the P., X. & Q. Railway had put in a kick at the cost of lard oil which was being used in the shops, and John Duzenbury himself thought this might be reduced; so he began investigations in a quiet way, to see if there wasn't some substitute which could be used with good results. He wrote to different firms he knew of for information as to their experience with substitutes for lard oil, and thought he ought to be able to find something that would do—if anything existed. He had read glowing testimonials of the various compounds, "Greasum and Soapum," "Lardoleum," etc., etc., and he had high hopes of being able to find something that would answer.

He increased Uncle Sam's postal revenue quite a little in writing around to his mechanical friends, and when the returns commenced to come in, he was happy, then puzzled, and finally a little discouraged; but he got over that later.

The Newton Machine Tool Works gave him their formula for a lubricant which they use in flooding their heavy milling cutters, as follows: 40 gallons water, 2 gallons best lard oil, 10 pounds whale-oil soap, 15 pounds washing soda; to be thoroughly dissolved and mixed before using.

The Acme Machinery Company wrote that on wrought iron they used a mixture of 3 gallons of water, 1 gallon pure lard oil, 1½ pounds washing soda; and for cast iron, kerosene or coal oil was used.

The Garvin Machine Company gave their formula as follows: To ⅔ of a bucket of water, add ⅓ of a bucket of good lard oil, 1 handful of washing soda. Steam into a boiling condition until soda and lard oil are well cut by the steam; i. e., thoroughly dissolved.

For brass, use: Olive-oil soap and kidney tallow refined in equal proportions. Make into soap with best washing soda; thin with hot water for use.

The Gisholt Machine Company recommended this solution: 50 gallons of water, 1 gallon of lard oil, 6 pounds of washing soda, 8 pounds drilling soap. Heat water to boiling point; put in soda and soap; mix these well together. Then put in lard oil and boil two hours. They added, significantly, "This costs 1 3-5 cents per gallon."

The Jones & Lamson Company wrote as follows: "Soda water does fairly well for malleable iron. We tried using it on steel, but after a struggle, we gave up, and dumped it into the river. It seemed to glaze the edge of cutters. For threading Norway iron, both sperm and fish oil give good results; but they smell to heaven and gum the work. Soda water isn't worth shop room for this work."

John showed the letters to his assistant, and, after he had read them over, he asked what he thought of them. Now Duzenbury's assistant, young Philpot, who had the misfortune to be first cousin to one of the directors, was a bright young chap, in spite of his relationship, and he had read them over carefully, for he was after information in shop lines as well as Duzenbury.

"Well," he said, slowly, "the whole business can be sized up about like this: Nearly everyone of them say lard oil is the best, and it's evident they only use their mixtures as a substitute, because they feel they can't afford lard oil. One or two of them say frankly that the more lard oil is in the mixture the better the result; one goes so far as to say, 'The better the lard oil, the better the result.' Now, Mr. Duzenbury, the question is, Can we afford to use lard oil?"

"I don't quite agree with you, Philpot," said Mr. D. "Seems to me more like this: Can we afford to use these mixtures, or, in other words, can we afford *not* to use lard oil?"

"But good lard oil costs from 35 to 40 cents a gallon, wholesale, and that's just what the purchasing agent is kicking about. Seems a pity to use so much as we have to, but I suppose it can't be helped."

"There's another point I don't entirely agree with, either," said Mr. D. "I've been looking this over and thinking it over, and I don't believe the trouble comes from the cost of lard oil, or from using it as freely as necessary, but from the waste of it. You hit it when you said we used so much. We do use altogether too much, and that's just the point I'm going to make with the purchasing department. I had hoped to find a good substitute for lard oil; but as I didn't, I have pretty good evidence that none exists, or at least isn't in general use. Now that we must use lard oil, the question is *how?* If we limit the men in quantity, the work and the tools suffer. If we don't, the P. A. kicks, as he has been doing, unless I can get him to buy me an oil separator, which won't cost over $75, and which ought to save three-fourths of the oil for use over again. It won't take so very much of Mike's time to look after it, and if it doesn't save money, I don't know what will. If I had my way, I'd put them in every shop on the system."

The discussion on the Brown system of Discipline without Suspension has received stimulated interest lately through the discussion at the Convention of Traveling Engineers. If anyone wishes to receive accurate information concerning the system, he should apply for our pamphlet on the subject, which is on sale in this office; 10 cents a copy.

Railroad men interested in the air brake ought to read Synnestvedt's "Evolution of the Air Brake," for sale in this office; price $1.

(Continued from page 759.)

solidated Rolling Stock Company are under way at the Michigan Peninsular Car Works.

The Atchison, Topeka & Santa Fé Railroad have completed two engines of the twelve under construction at their Topeka shops.

The Long Island Railroad have ordered three Russell snow plows from the Ensign Manufacturing Company, of Huntington, W. Va.

Four standard eight-wheel engines are being built for the New Orleans & Northeastern Railroad, at the Richmond Locomotive Works.

One six-wheel connected engine is under construction at the Schenectady Locomotive Works for the Portland & Rumford Falls Railroad.

Seven six-wheel connected engines are being constructed at the Baldwin Locomotive Works for the Houston, East & West Texas Railroad.

Two 20 x 26-inch engines, weighing 150,000 pounds each, have been completed at the Burnham shops of the Denver & Rio Grande Railway, duplicating some engines built for them by the Baldwin Locomotive Works one year ago.

The Kansas City, Pittsburg & Gulf Railway are having 250 freight cars built by the Missouri Car and Foundry Company; 400 freight cars built at Pullman's, and 200 freight cars built at the Michigan Peninsular Car Works.

The Canadian Pacific Railway are building 200 standard 60,000-pound cars at its Perth shops, and has placed orders for more cars, as follows: 200 flats with the Rhodes Curry Company, Amherst, N. S.; 250 box and 200 flats with the Crossen Manufacturing Company, of Cobourg, Ontario.

Brazing Graphite.

Not a little of the expense in brazing is due to the cost of removing the brass which has stuck to the metal where it is not wanted. The removal of this brass is usually attained only by patience and diligent filing. Now comes to the aid of the brazier that unique mineral, graphite, which is not affected by acids, alkalies, heat or cold. Braziers who have made use of Dixon's Pure Flour of Graphite pronounce it worth its weight in gold. A sample will be sent without charge by the Joseph Dixon Crucible Co., Jersey City, N. J., who are the only manufacturers.

The Ingersoll-Sergeant Drill Co. are gratified at receiving an order from J. B. McDonald and Andrew Onderdonk, contractors of the Jerome Park Reservoir, N. Y., for a large air compressor plant, duplicating the plant which they now have except that the new plant ordered will be larger and has both steam and air cylinders compounded.

The Lodge & Shipley Machine Tool Company.

Since November, 1893, the Lodge & Shipley Machine Company, Cincinnati, O., have been manufacturing improved engine lathes under patents of their own. One essential difference between their lathes and most others lies in the fact, that all the change gears are always mounted, and that any desired thread the lathe is capable of cutting may be obtained instantly without ever taking off or putting on gears; also, that the range of threads and feeds is very large. That this policy of making one line of goods pays is shown by the steady growth, until they now own and use a building with three floors, 96 x 71 feet, in which are the latest and best machine tools, jigs and special appliances adapted to their work.

The fact that they make nothing but engine lathes, enables them to offer such a line as could not be offered by a concern devoting its attention to a miscellaneous lot of machine tools. They have been running full force and full time steadily; but the demand has prevented an accumulation of stock, and they are arranging for a still further expansion of their business, in order to enable them to make up and carry in stock some of their lathes. They report a decided improvement in domestic orders, and their foreign trade still remains brisk.

President Duntley, of the Chicago Pneumatic Tool Co., who has lately returned from a visit to Europe, reports that the orders received for his tools were away beyond his highest expectations. Ten or twelve of the leading railways in Great Britain have purchased pneumatic drills and caulkers, and the demand from ship-building firms is surprisingly large. The company's works are now running 22½ hours a day, and yet they are not able to keep up with the demand. The company is about to open an office in New York.

The C. H. Haeseler Co., 1026 Hamilton st., Philadelphia, Pa., have favored us with a copy of their latest catalog of portable pneumatic tools. Photographs are shown of the tools at work, which are sure to interest railroad men, particularly boilermakers. Among the tools are drilling and tapping machines, chipping and caulking tools, air motors, etc. Copies of this catalog will be sent on application to the firm named.

The Davis & Egan Machine Tool Co., of Cincinnati, O., have just been awarded a contract by the French Government for four heavy 36-inch engine lathes with 22-foot beds. These lathes are to be equipped with metric lead screw and full set of change gears for cutting a large range of threads.

Mileage Books in Baden.

The railways of Baden have been experimenting with a mileage book which is decidedly liberal in its conditions and cost. The books are good for a year, and can be used by the purchaser, members of his household and his employès.

Travel is induced by giving a discount of 5 per cent. on the sixth, 10 per cent. on the seventh, 15 per cent. on the eighth and 50 per cent. on the fifteenth book purchased within sixteen months. In spite of opposition by railway men, it has worked so satisfactorily that it seems likely to be adopted by other German States. The second and third class passengers also receive the full benefit of these books.

The American type of passenger car would seem to be slowly but surely pushing its way into the affections of the people who live abroad, but have appreciation of its comforts and conveniences. The Waterloo Underground Railway, of London, England, is one of the last foreign roads to try our style of car, they having ordered twenty-five of them from the Jackson & Sharpe Company. Responsibility for this break from time honored precedent may very likely be attributed to popular demand.

The forgings in the engine of the torpedo boat "Rogers," which broke last week, causing considerable damage to the machinery, are being replaced by forgings from the well known works of the Bethlehem Iron Co., at South Bethlehem, Pa. The forgings which broke were not made by this concern.

Few people who are not connected with railroads realize the amount of material necessary.

The Baltimore & Ohio are now laying in large quantities, and the amount per mile is interesting. Their rules require 133.57 tons of 85 pound rail for one mile of track. Ties are laid 24 inches from center to center, making 2,640 per mile. Four spikes per tie calls for 30 kegs, or 10,800 spikes, weighing 6,000 pounds or three tons. In each mile of 30-foot rail are 352 complete joints, requiring 704 splice bars and 1,408 bolts. They are using what is known as the "Continuous Rail Joint Splice Bar," which is supposed to prevent low joints, the bane of a trackman's life.

A patent has been issued to a man in Kansas for a pneumatic cylinder arrangement for raising car windows. It is below the window, and a small thumb latch admits air to the cylinder, and up she goes. Compressed air is a fine thing; but we have seen car windows that nothing less than dynamite—in generous doses—would induce to move.

Another Method of Laying Dust.

New Jersey railroad men seem to be of an inventive turn of mind this year, and the scheme of sprinkling the roadbed with oil to lay the dust and keep it laid, has a rival in the plan which Superintendent Price of the Tuckerton Railroad has been trying this summer on his own line from Whitings to Barnegat, a distance of 17 miles.

He first tried oil, but is now using brine instead. It is a pretty strong solution and the salt which finds its way to the ground attracts moisture from the air and tends to keep the ground sprinkled sufficiently to keep down the dust.

This has worked well this year, but as the summer has not been a particularly dry one, the experimenters are not allowing themselves to become too sanguine as to results in a very dry season.

The salt seems to have the advantage of not making the ties more inflammable as the oil shower bath must do.

Press dispatches reported last month that after a butting collision which happened on the Denver & Rio Grande one of the Pintsch gas tanks exploded, causing a fire. A thorough investigation of the matter has been made, and the railroad company ascertained that all of the tanks were intact, and that the story of the explosion was one of the blunders so common with ordinary reporters when writing about railroad matters.

The allegorical tale of "Doctor Standard" is founded on fact. Don't fail to read it.

The United States revenue cutters and torpedo boats afford opportunity for the use of specially designed fans and engines, and the Buffalo Forge Co. have had considerable success in meeting the requirements of this service. A number of orders are now in process, the most recent being the United States torpedo boat No. 17. The electric light plants of the Government, both on shipboard and land, are a field for the introduction of Buffalo automatic engines.

An Ohio man has invented a spark arrester in which he uses a straight stack with a bad swelling near the base to make room for a cornucopia which is supposed to catch the sparks and coax them to fall down into the front end.

We believe this device will prevent sparks while it lasts, for there wouldn't be draft enough to induce any but an ambitious spark to leave the fire-box, but when these ambitious sparks get to work, there will be holes enough in the cornucopia so it can be used for a colander or an ash sieve.

There are many phenomena in nature that seem paradoxes and therefore to ordinary understanding unnatural. One of these paradoxes may be observed in every foundry where alloys of copper and tin are cast. Copper and tin are both soft ductile metals when separate, but when they are melted together in a crucible, they form bronze, which is much harder and stronger than either of the metals from which it was made. Nine parts of copper and one part of tin melted and mixed form the alloy called gun-metal. This alloy, unlike the metals from which it is formed, is very hard and tough, and has no ductility to speak of. Of the two metals constituting the alloy, tin is much the softer; yet an increase in the proportion of tin to copper hardens the alloy. When the mixture is one-third tin and two-thirds copper, an alloy is produced so hard that steel tools will not cut it, and so brittle that it flies to pieces when struck light blows.

The bath for tempering springs at the Springfield shops of the Wabash Railroad is gotten up on a turbulent principle—the oil which constitutes the cooling medium being kept in a state of agitation by means of compressed air passing through a perforated pipe situated in the bottom of the tank. At the side of the air pipe is located a steam pipe for warming the bath and keeping it at an equable temperature. This idea was worked up by Superintendent of Motive Power Barnes, and he is authority for the statement that the scheme is one of the best, for the reason that the incoming air keeps everything stirred up in the tank—no stratums of varying temperature.

We have received one of the "somethings" that are sent to draftsmen who send their address to the Joseph Dixon Crucible Company, Jersey City. It's a good "something," too—almost makes us wish we were draftsmen ourselves.

"It is no less a fatal error to despise labor," says Ruskin, "when regulated by intellect than to value it for its own sake. We are always in these days trying to support the second. We want one man to be always thinking and another to be always working, and we call one a gentleman and the other an operative; whereas the workman ought often to be thinking, and the thinker ought to be working, and both should be gentlemen in the best sense. As it is, we make both ungentle, the one envying, the other despising his brother, and the mass of society is made up of poor thinkers and miserable workers. Now it is only by labor that we can be made happy, and the professions should be liberal, and there should be less pride felt in peculiarity of employment and more in excellence of achievement."

Experience in Preventing Leaky Tubes and Fireboxes.

Mr. John Mackenzie, superintendent of motive power, Nickel Plate, has gone through some very edifying experience lately with the care of boilers and feed water for the same. They have on the system, one water station which has 98 grains of solid matter in solution to the gallon, most of it being sulphate. In order to avoid using this water, the company had to take water at a town where it cost 6 cents per 1,000 gallons. Mr. Mackenzie conceived the idea that something could be done to make the bad water fit for steam-making. He put a water tank on the ground, filled it with water and then applied a certain quantity of soda ash and carbonate of lime. A steam jet was then laid into the water, which stirred it up sufficiently to mix and melt the ingredients put in. The water was permitted to settle after this operation and then pumped into the supply tank. The company are using the water thus treated very successfully and at considerable saving of money.

The bad water on the system had got the men in charge of engine houses in the habit of washing out boilers very frequently with the view of preventing leakage of tubes and fire-boxes, but still there was a great deal of trouble from this source of annoyance. Mr. Mackenzie conceived the idea that there was too much washing out and he took a passenger engine to make a test of it. He had this engine's tubes rolled and the fire-box properly cooled, then he gave orders that the engine should be run 4,000 miles before the boiler was washed out. This was done, and the engine went through the ordeal without any leakage. An order was then given that freight engines should run 2,000 miles without washing out, and passenger engines 4,000 miles. Since that practice was adopted, there has been remarkably little trouble from leaky tubes or fire-boxes.

When the washing out is done, it is performed very effectually and thoroughly and an engine is held at least six hours in going through the operation. Water is applied with the greatest possible force in every point where mud or dirt can be reached. After a thorough washing, the boiler is filled up with hot water and a slow fire started as a preliminary to steam-raising.

A novel practice on this road is that they catch in a sealed pit the hot water run out of the boiler and employ it in washing out.

The United States Metallic Packing Company, Philadelphia, Pa., are sending out a very neat ad. in the shape of a mounted photo of the Atlantic City flyer, No. 1,027, whose piston rods and valve stems are packed with United States metallic packing.

OF INTEREST TO DRAFTSMEN.

Any draftsman who in his work requires fine, clear-cut lines, free from "feather edges," will receive something that will please him, if he will send his address to the Joseph Dixon Crucible Company, Jersey City, N. J.

A Spoiled Car Porter.

The spoiled servant is not a common person in America, but people rub against one occasionally and then he is found to be a little worse spoiled than his kind in any other part of the globe. The very worst case of spoiled servant we have ever met was a colored porter who is in charge of the private car of Sir William Van Horn, president of the Canadian Pacific.

This indivdual's name is Jim French, and he likes to talk and talks very glibly about "me and Sa William." On a recent occasion Sir William's car was carrying a party of eminent doctors over the continent, and as usual Jim was in charge. At one division point a brakeman stepped on to the sleeper and asked the porter who was in that private car. "Jim French and Lord Lister," was the reply.

Unlike most colored men Jim French is given to the use of profanity as seasoning to his conversation, and he is not particular about who hears his oaths. A short time ago the Hon. Mr. Blake, M. P., made an official inspection of Canadian Pacific property and he traveled over the continent along with Sir William in the private car. Before starting Sir William enjoined Jim French to refrain from swearing during the trip, as the Hon. Blake was a religious sort of man. Jim promised and his behavior was beyond reproach until the train reached Winnepeg. There is a custom at that place of washing the dust off through train cars by means of hose water jets. It happened just as Jim French pushed his head out of the window the jet from a washing hose caught him in the ear. That was too much for his rectitude and he swore enough to make the air lurid.

Sir William and his guest saw what happened and heard the expletives. After peace was restored Sir William took the porter in hand and scolded him for the violence of his language and finished by saying, "You must go and make an apology to Mr. Blake for the disgraceful language you used."

"Yes, Sa Willum, I go make all de pologies you want," said Jim.

"Well go right in and apologize."

Jim walked into the observation room where he found Mr. Blake and said, "Mass Blake, I come make pologize for the langwadge I done use to dat car washer. I know dere was no 'scuse for me. I ought know better dan dat, for befo' we started Sir William gone tole me dat you was a pious sort of a cuss."

The apology was considered satisfactory.

A circular recently issued by the Peerless Rubber Manufacturing Company, of New York, contains a portrait of Mr. John H. Deming, general superintendent, the inventor of Rainbow Packing, and the only man who ever has made it, can make or knows how to make it.

An Engineer's Good Record on the Atlantic City Railroad.

A letter of this kind makes an engineer want to shake hands with himself, as we all like to be appreciated, and it pays to show the men that they are not forgotten. The letter is reprinted from the Philadelphia "Times":

"September 8, 1897.

"Charles H. Fahl, Engineman, Atlantic City Railroad, 1825 Broadway, Camden, N. J.:

"Sir—Your performance with train No. 25 during the past two months deserves special commendation. This train, now withdrawn for the season, was scheduled to run from Kaighn's Point, Camden, to Atlantic City, fifty-five and one-half miles, in fifty-two minutes, or at the rate of sixty-four miles per hour. Owing to the inability of the ferryboats to reach Camden on schedule time the train always left late, the average detention from this cause being upward of two minutes. On the other hand, you so ran the train that this loss was invariably made up, the train arriving at Atlantic City always ahead of time, this average being also two minutes, so that the record shows that for the fifty-two days the train ran, from July 2 to August 31, the average time consumed on the run by you was forty-eight minutes, equivalent to a uniform rate of speed from start to stop of sixty-nine miles per hour.

"On twenty-two days the train consisted of five cars, on thirty days it made up with six. On no occasion did it fail to arrive at Atlantic City on time. This performance, I believe, has not heretofore been equalled in the history of railway service either in this country or abroad. It is one of which the management is proud and is a credit to the track, the equipment, and especially to the skill and ability with which you performed the task entrusted to you.

"I take pleasure in offering you my thanks for the fine service you have rendered the company. Very truly yours.

"THEODORE VOORHEES,
Vice-President."

A handy roundhouse arrangement for an air lift is one in use on the Minneapolis & St. Louis Railway, at Minneapolis. The air cylinder is carried on a rail, continuous from one side of the engine to the other by encircling the front of the engine, the rail hanging vertically over each cylinder at an elevation somewhat higher than the stack. The advantages of such a device in lifting heavy parts like a stack, cab or steam chest, are so apparent as to carry their own recommendations.

L. S. Starrett Company find their business increasing so rapidly that they have opened an office at 126 Liberty street, New York. This will be in charge of Mr. A. H. Briggs, who is well known in machine-tool trade

INDEX TO ADVERTISEMENTS.

Buyers' Finding List.

AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll Sergeant Drill Co., N. Y. City.
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co. Philadelphia, Pa.
Rand Drill Co., New York.

AIR LIFT PUMPS.
Clayton Air Compressor Works, New York.

AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

AIR PUMP GOVERNORS.
Mason Regulator Co., Boston, Mass.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
Carey Mfg. Co., Philip, Lockland, O.

AXLES.
Cambria Iron Co., Philadelphia, Pa.

BALANCED SLIDE VALVES.
Am. Bal. Slide Valve Co., San Francisco, Cal.
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
Peerless Rubber Mfg. Co., New York.

BENDING MACHINES.
Long & Allstatter Co., Hamilton, O.

BICYCLES.
Pope Mfg. Co., Hartford, Conn.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER COVERINGS.
Carey Mfg. Co., Philip, Lockland, O.
Keasbey & Mattison Co., Ambler, Pa.

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Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa.
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. Wks., Richmond, Va.

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Acme Machinery Co., Cleveland, O.
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Montgomery, Ward & Co., Chicago, Ill.
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Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

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Q. & C. Co., Chicago, Ill.

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The Sargent Co., Chicago, Ill.

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Paul S. Reeves, Philadelphia, Pa.

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Gould Coupler Co., Buffalo, N. Y.

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National Malleable Castings Co., Chicago, Ill.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

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BUYERS' FINDING LIST—*Continued.*

CAR DOOR FASTENERS.
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CAR FORGINGS.
Dickson Mfg. Co., Scranton, Pa.

CARS, FREIGHT.
Allison Mfg. Co., Philadelphia, Pa.

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William C. Baker, New York.
Safety Car Heating & Lighting Co., New York.

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CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

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CAR WHEEL BORERS.
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Star Brass Mfg. Co., Boston, Mass.

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FORGINGS.
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Brooks Locomotive Works, Dunkirk, N. Y.
Richmond Loco. & Mch. Wks., Richmond, Va.

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GAGES.
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BUYERS' FINDING LIST—*Continued.*

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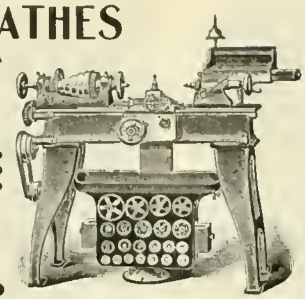

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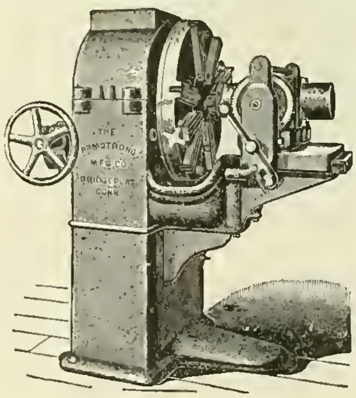

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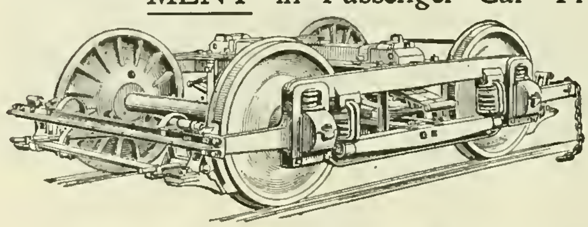

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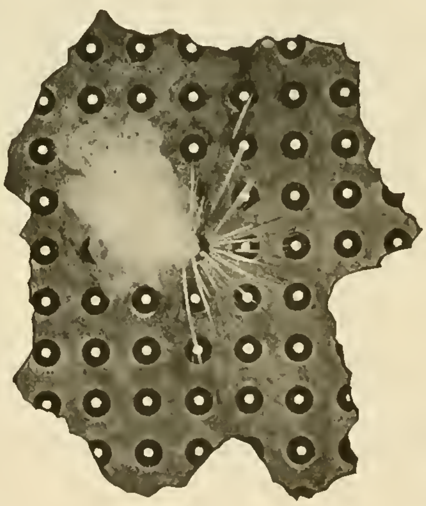

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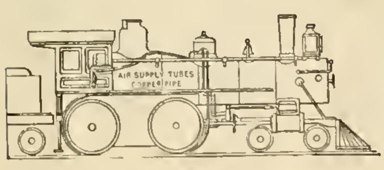

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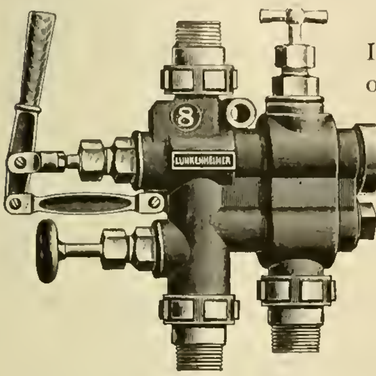

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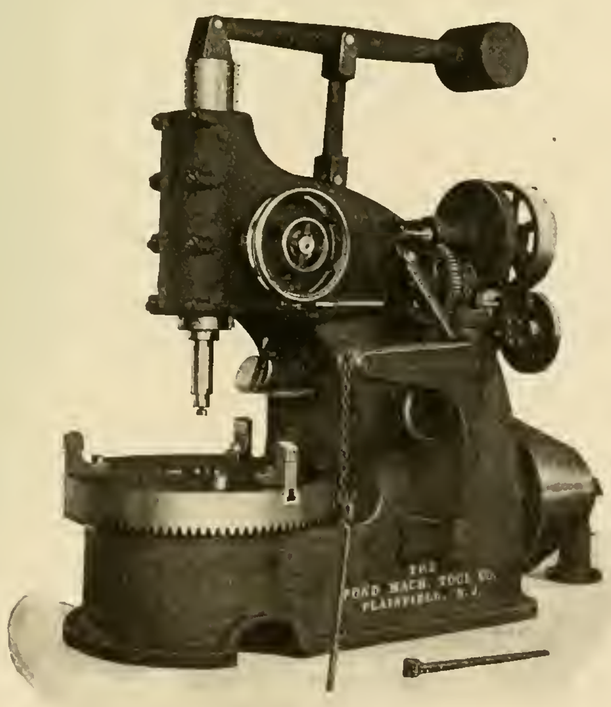

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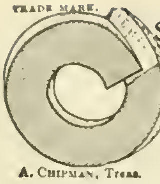

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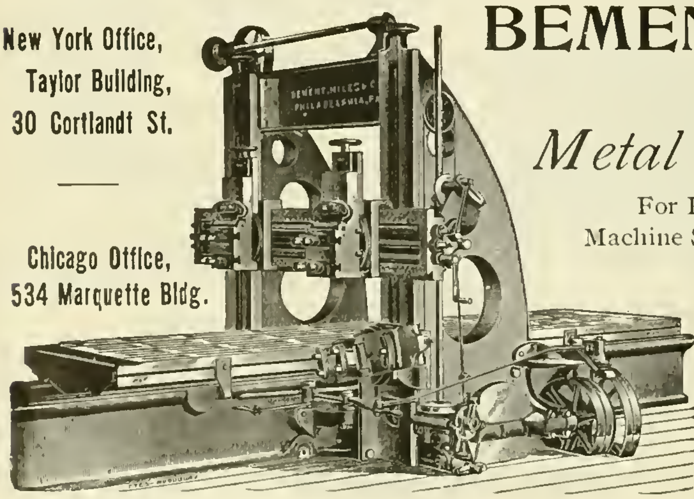

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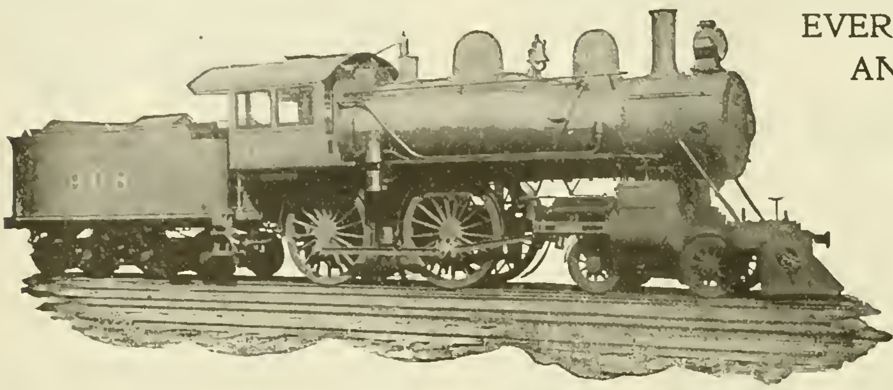

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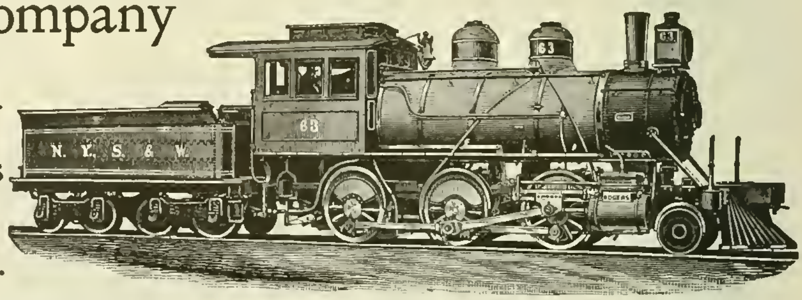

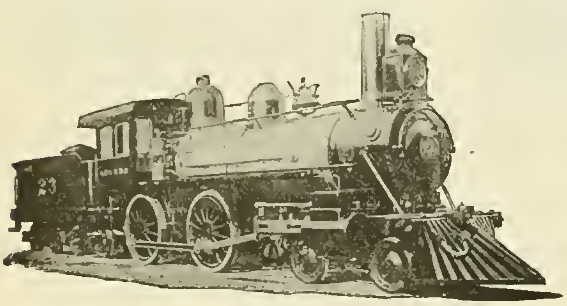

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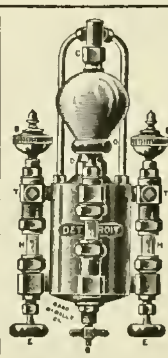

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ANNUAL CAPACITY, 1,000.

Single Expansion and Compound Locomotives

Broad and Narrow Gauge Locomotives, Mine and Furnace Locomotives, Compressed Air Locomotives, Steam Cars and Tramway Locomotives, Plantation Locomotives, Oil-Burning Locomotives.

Adapted to every variety of service, and built accurately to gauges and templates after standard designs or to railroad companies' drawings. Like parts of different engines of same class perfectly interchangeable.

Electric Locomotives and Electric Car Trucks with Approved Motors.

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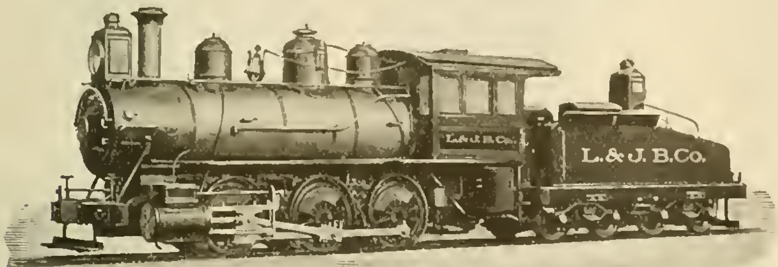

Established 1865.

Richmond Locomotive

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Machine Works,

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LOCOMOTIVES FOR EVERY SERVICE.

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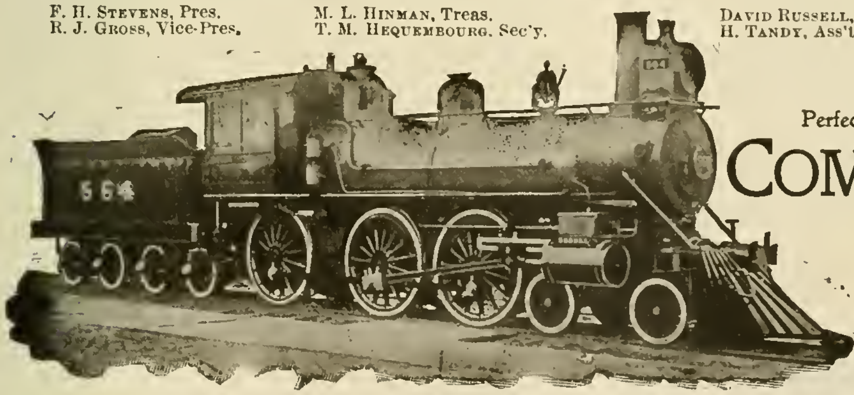

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Passenger and Freight Service.

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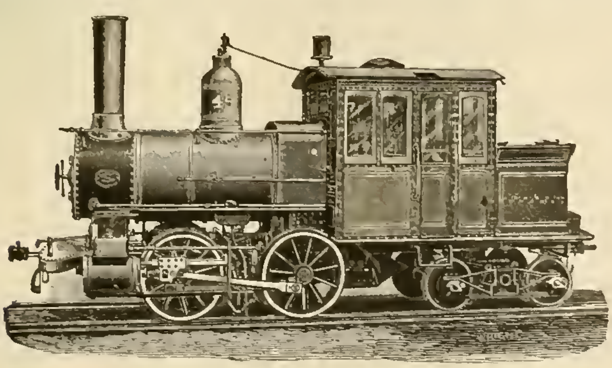

Pittsburgh Locomotive

Manufacturers of **Works,** PITTSBURGH, PA. U. S. A.

Locomotives adapted to every variety of service, from standard designs or purchasers' specifications.

Builders of the Most Successful Compound Locomotives in the World.

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LOCOMOTIVE ENGINEERING
A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

[Trade-Mark Registered.]

Vol. X. NEW YORK, NOVEMBER, 1897. No. 11.

New Orleans Limited.

The annexed engraving shows a magnificent limited express train running on the Queen & Crescent Route, as the Cincinnati, New Orleans & Texas Pacific Railway is popularly called. The photograph from which the engraving was made was taken when the train was running 61 miles an hour, as shown by an automatic speed recorder.

In the Blue Grass Between Burgin and Danville. NEW ORLEANS LIMITED. At a speed of 61 miles per hour, as shown by an accurate recorder on locomotive. Queen and Crescent Route.

This is one of four which are known as the most celebrated express trains in the country, and the feat of running it from Cincinnati to New Orleans, a distance of 826 miles, in 22 hours is the hardest to accomplish of anything performed in express running on this continent. Yet the train of five heavy cars is nearly always taken through on time, which is highly complimentary to the engines doing the work and to the management of the train service. The run from Cincinnati to Chattanooga, 336 miles, crossing the Cumberland Mountains, over a very hilly road, with numerous tunnels and sharp curves, is made in 8½ hours, an average speed of about 40 miles an hour, including stops. The causes for reduction of speed on this part of the route are so numerous that an average speed over 60 miles an hour must be maintained on other parts to make the running time.

The cars are said to be magnificently equipped and equal to anything found on wheels.

The engines that work this train are ten wheelers of Baldwin make, with cylinders 19 x 24 inches, driving wheels 68 inches diameter. The boiler is 58 inches diameter at smallest ring and provides 1,811.4 square feet of heating surface, 140.8 of which is in the firebox. The grate area is 18.7 square feet. The steam pressure carried is 180 pounds. The boilers are said to supply all the steam the cylinders can use.

These engines are said to be almost smokeless, although they burn bituminous coal rich in hydro carbons. Mr. J. P. McCuen, superintendent of motive power, writing about this valuable characteristic of the engines, gives the first credit to the skill and care of the firemen, and adds that the work of these men is aided by firebrick arches, which have air tubes running through them and deflecting air tubes placed in the sides of the firebox. With these smoke preventatives the engines are said to run from start to terminus with as little smoke as can be seen at the moment the photograph was taken.

Development of Our Iron-Making.

Prior to 1838 the manufacture of pig iron was in a primitive condition, that metal being practically all made in charcoal furnaces producing from 15 to 30 tons per week, converted into wrought iron in the old-fashioned charcoal fires, and was shaped into blooms for the rolling mill and into bars for the smith by a helve hammer. The furnaces, forges and mills were all driven by water-power, and were kept in order by what was sometimes called a forge carpenter or millwright. At this time the mills were all geared, the shafts being square, hexagon or octagon, according to the fancy of the millwright; the wheels were secured on the square shafts by wooden blocks, and in them were driven thin iron wedges; the segments of the wheels were secured to the center in the same manner; the roll housings were all set on wood. All this crude machinery the millwright was called on to keep in running order; consequently he became an important man.

In 1840 the use of anthracite coal and coke in blast furnaces was commenced. This required a much higher pressure of blast. Previous to this time the blowing cylinders had been made out of wood, the pressure of blast being very low—not exceeding 1½ pounds; hence a great improvement in blowing machinery became necessary.

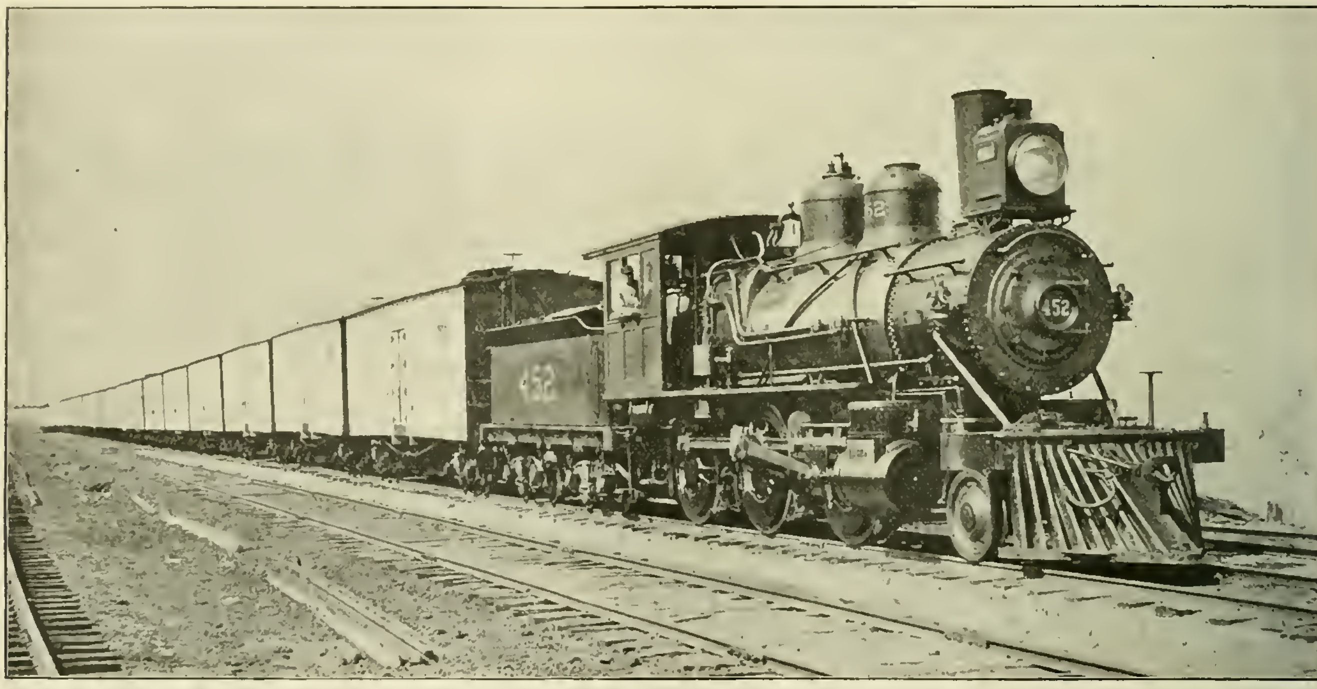
In 1842, puddling began to come into more general use, and puddling trains had to be built, and better merchant or bar trains were now required; they were all geared, and gave much trouble. The machinist now had to be called in to help to keep things in shape, and he soon took the millwright's place, and became the precursor of the mechanical and metallurgical engineer.

In 1845 the rail mills were being built, and stronger and better workmanship was required. These mills were all geared, but the shafts were generally turned up, and wheels all bored out, and fitted up in a much better manner, which required more skill and better workmen. Puddling now became an important branch of the iron business, and the Old Harry was generally to pay to get the balls in proper shape; to do this mills were using the old Welsh hammer. Numbers of squeezers were tried and failed; finally the Burden squeezer was invented and adopted by the mills generally, and to this day is the best machine that has ever been devised for the purpose. In or about the year 1848 "boiling" came into use, which was a great improvement over ordinary "puddling," and gave a new impetus to the trade. From 1848 to 1856 no marked improvements were made in the business. In 1857 the three-high rail mill was successfully introduced, and in a very short time practically revolutionized the manner of rolling rails. From this time on, all the new mills that were built were driven direct, without gearing, and much stronger and better in every way. It was during this time that the great changes and improvements were being made in rolling-mill and blast furnace machinery, and also in machine-shop tools of all kinds, which enabled much better work to be turned out than had been previously possible.

In 1864 the Bessemer process was introduced, and it soon became evident that it would in a short time revolutionize the iron business. Its introduction and perfection will ever remain one of the most interesting and important epochs in the whole history of the iron business. It was now that the men who had been in training were called to the front.

In order to show what the Bessemer process can do in coal and labor, as compared with puddling, it may be stated that the former can produce in ten minutes 10 tons of steel ingots, with a consumption of 2,000 pounds of coal. It will require a puddling furnace ten days, with practically three men, to produce a like amount of puddled iron, and will require about 20 tons of coal. The puddling is a hard, laborious and exhausting occupation. The Bessemer requires care and attention only, but these it must have.

We left the blast furnaces in 1840, making 15 to 30 tons per week, and producing in that year 286,903 gross tons. In 1895 we have furnaces producing between 2,000 and 3,000 tons per week, and others building that are expected to make much more. The total output in 1895 was 9,446,308 gross tons, which exceeds the quantity made by any other nation.—President Fritz to A. S. M. E.



AN ILLINOIS CENTRAL EXPRESS FREIGHT TRAIN.

Jim Skeevers' Object Lessons.

BY JOHN ALEXANDER.

How a Good Thing Gets Introduced—Some Little Annoyances of Master Mechanics.

James Skeevers, superintendent of motive power of the Great Air Line, was in trouble.

A superintendent of motive power is generally in trouble.

Skeevers has a new general manager, who is young in years and experience and is trying to make a reputation.

Like many other men who inherit or marry a "pull" that puts them in positions of command, the new general manager had an idea that to be familiar with all the details, and run them, would show his ability to swing everything on a big railroad.

The new general manager had been taught in his youth, as most of us have, that old, old chestnut about looking after the pennies and the dollars would look after themselves.

This proverb is good for boys and in the small affairs of life, but it's suicide for a man in charge of a big railroad.

The new general manager had been to a dinner of railroad men, where the irrepressible oil crank read a memoranda of the miles his engines run on a pint of oil, and showed what a saving in *pints* his management had made.

Mind you, he didn't say a word about *dollars*—for the saving in them wouldn't pay his salary for three days.

Well, the new manager took notes of the miles and the pints, and when he got home he compared them with the performance sheet furnished by Skeevers—then he wrote Skeevers a letter.

It wasn't a letter asking if he couldn't get the boys to do better on oil, or if there were any local conditions that prevented a better showing—there wouldn't be any authority in that—it was a letter stating that the amount of oil used was out of all reason and must be stopped at once, that so-and-so many pints for valves and so-and-so many pints for engines was enough—all other roads used, and all this road was going to use: "please see that these instructions are carried out forthwith," etc., etc.

Skeevers read this letter over twice, put his feet on the window-sill and commenced to think.

Skeevers thought of a way out of the difficulty.

There was one way—a first-class machine shop had offered him a job as superintendent; but that seemed like a retreat to Skeevers, and Skeevers is not much of a retreater.

Skeevers came up from the ranks on this very railroad, learned the trade in the shops, fired and run engines for years, and knew a lot of things about oil and the craze on skimping it.

For one thing, Skeevers knew that the amount of money wasted in oil was not very large, and he also knew that he could save more dollars in coal than pennies in oil, and yet the oil problem was not to be despised, and must be met.

While he was looking out of the window, Jerry Sullivan backed his big mogul down near the office and took his long-spouted can and two hundred pounds of engineer down to oil 'round.

Jerry is a good, careful man with oil, and everything else, and Skeevers watched him.

GROUP OF WESTINGHOUSE AIR-BRAKE OFFICIALS.

The Great Air Line furnish the plain, mongrel breed of tin can, with 22-inch spout, a filling plug and, generally, a gob or two of solder around the bottom, where it has been repaired. Jerry started at the back driving box, made a quick dive with the spout between the spokes, lifted the sheet metal box cover with the spout, and with dexterous turnings of the wrist put the thin oil on wedge and shoe and box packing, and then withdrew the spout with a quick drop of the right elbow—this to stop the flow of oil.

For all this care—and Skeevers couldn't have done it better—there was a nice little canal of oil across the hub of the wheel; but Jerry wiped it off and went on. When it came to the links and eccentrics, Jerry couldn't help pouring a steady stream of oil from one small oil hole to another, as it was impossible to stop and start the flow of oil for each. Skeevers watched him oil around and back down for his train, then he went out and looked the ground over.

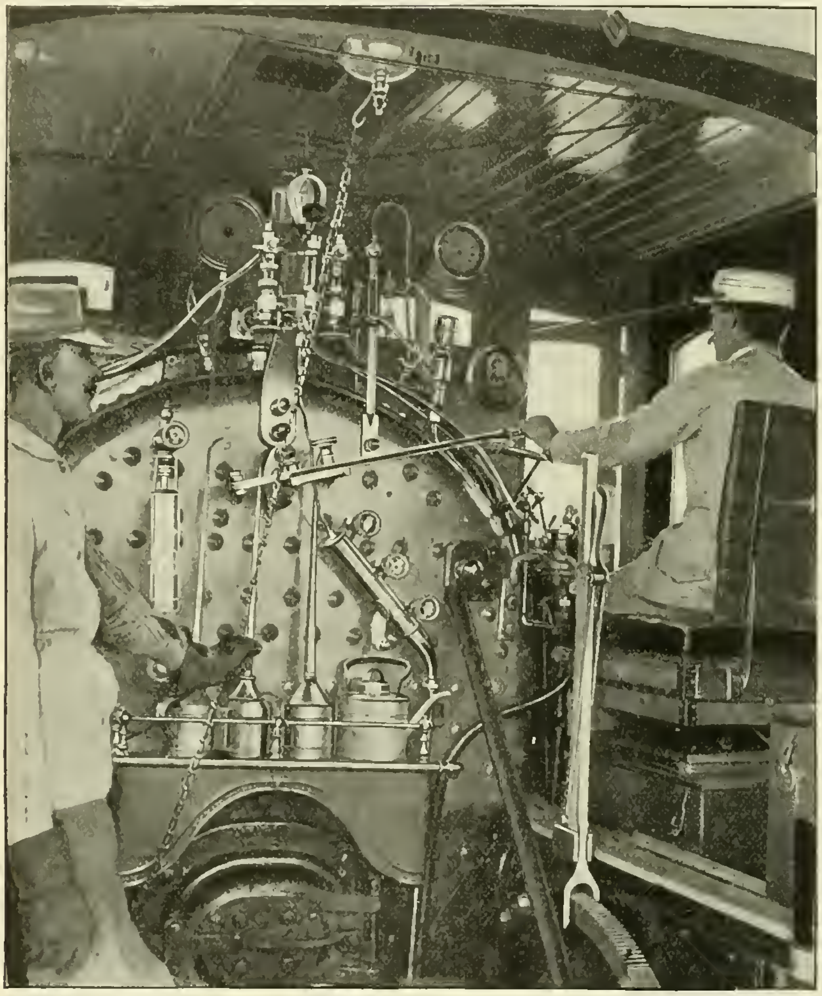
There was a very complete plan, in oil, of Jerry's engine; every driving box and truck box, eccentric and link was properly located—on the ties.

Skeevers went back and figured that Jerry or the 109 had lost at least a quarter of a pint of oil—and Jerry was probably the carefulest runner on the road.

Then Skeevers figured out that an engine in service gets, probably, three good oilings in a hundred miles, or an average day's work, to say nothing of extras for guides, eccentrics, etc., between times, and that he had in service 217 engines. If he could save the waste in oiling, the engines would not get skimped, and it would make a show.

Skeevers made a bee-line for the tin shop.

"Josh," said he, "we've got to get up a valve oil can that will shut the spout with a valve and spring, something like this," and Skeevers fished up a pencil and made a rough sketch on a sheet of tin.



BOILER HEAD OF UNION PACIFIC ENGINE.

Old Josh didn't say a word, but went to a cupboard and got out about half a dozen cans, of all shapes and sizes, in all stages of decay—and all of 'em had valves. He picked out one that was a twin sister to the one Skeevers had pictured.

"Well," said Skeevers, "what was the matter with that one? I remember they were tried a long time ago; but I never got one then, for I was running out of Granger, and all the new things were tried up at this end of the road."

"'T wan't no good," said Josh; "least-wise it didn't work, sir; cost twict as much as a good tin can—yes, three times. Allus needed fixin', and the engineers didn't like 'em—dog-gonned engineers never do like nothin' new, anyhow," muttered Josh.

Just here John Melvin came into the tinker shop to get a new bottom put into his tallow pot—isn't it curious that the boys will call 'em tallow pots yet, when valve oil superseded tallow fifteen years ago?

"John," said Skeevers, "you were here when all these cans were tried—what's the matter with 'em?"

"Well, sir," said Melvin, slowly (Melvin was a careful man), "they were a nuisance, mostly because they were no good anyway, and some because they was made poor and took care of poor. Now, this one, as you can see, has a valve up in the spout; a crooked wire goes down the spout, makes a turn in the can, and comes up through this stuffing box with a thumb button on it. When you press this button the wire pulls the valve *down* into the spout. If the least bit of waste or raveling gets in there, it will stop up the can, and you can't get it out—the spout is soldered on."

"Well," continued Melvin, "Massey (the ex-superintendent of motive power) got up this here other can, to overcome the objections to that; it's got a big valve right at bottom of spout—flat disk on end of lever opens down. This drizzles about as bad as any can when the valve is shut, because the spout is full of oil. The filling hole is higher than the valve, and in this case was a good brass plug screwed in, with a knurled top. Why, Massey got a patent on that can! He'd a made a go of it, 'cept for Doc Kellog. Didn't you hear of that? Well, Doc was firin' for Jerry Sullivan then; he filled one of them cans one cold day, and run it over, of course (that's the way to tell when they are full); then he screwed down the plug and set it on the boiler-head shelf.

"Well, sir, ten miles this side of the Springs that can busted, and give Doc a shot of hot oil right in the neck as he was puttin' in a scoop of coal. The door bein' open, he took fire, and was bad burned—got the marks of it yet. He jumped into a snow bank and saved his life. Jerry climbed out on the running board to get away from the fire, and the '98' had a cab burned off before he got her stopped.

"Old man Wider come up to the shop the next day, and you ought to aheard him lay down the law to Massey. All the patent cans was took off the engines that night, and we ain't been bothered with 'em since."

Skeevers went back to his own office.

"Supply man here," remarked his clerk; "left a note for you, and a package; said he was going over to see Massey; be back to-morrow."

Skeevers' clerk was very laconic; he was washing up, for it was five minutes of six, and he had a new wife in a new house.

Skeevers opened the note and read:

"Mr. Skeevers: Here is on oil can that is all right; take a look at it, try it, criticise it—see you to-morrow.

"P. S.—Price $1.50 each—last three tin cans.

"R. USHER."

Skeevers took two cans out of the package—one was cut open on side to show internal economy—looked at them until whistle blew, and then bundled them up and carried them home.

Skeevers spent two hours fooling with that can in his kitchen sink; then he sat down, looked at the sectional one, and made notes, until Sarah Skeevers declared for the seven hundred and seventeenth time that if he didn't stop bringing home his worry and work, she'd burn every blueprint and smash every brass faucet he brought into the house.

R. USHER'S OIL CAN.

The next morning, after opening his mail, Skeevers took the cans and his note book to the general office. In an interview with the new general manager he told all about his investigation of the waste of oil in getting it on the engines; told the whole story about the old cans that had been tried, and then sprung the new can.

"Now, sir," said Skeevers, warming to his work, "here is the can we need, I think. In the first place, it is made of pressed steel—it will last the life of three tin cans at least. The valve in spout opens *up*—easy to clean. Valve, rod and spring come off with the spout—get-atable. Fills through spout connection—no plug to leak. Has an air chamber inside that is always open to atmosphere—through the lever shaft, which is hollow—but only to can when valve is open. Shuts off oil at right place in the right way; engineer can deliver but a drop if wanted. It's a mechanical job, ground joints—no leather gaskets, no packing, to wear out or get lost and make the point of spout point toward handle of can. There are no 'jimcracks' to get out of order; the whole thing from tip to base is made of No. 22 B. W. G. steel; couplings are all brass; spring is bronze, and the whole thing is nickel plated. Why, sir, the meanest engineer on the road would take care of that can. Keep it clean, and he couldn't help using it right.

"I think all the saving you want can be made by using these cans—and the engines will actually get and use just as much oil as ever."

"Ahem! How much did you say that can cost, Mr. Skeevers?" asked the new general manager.

"One fifty, sir."

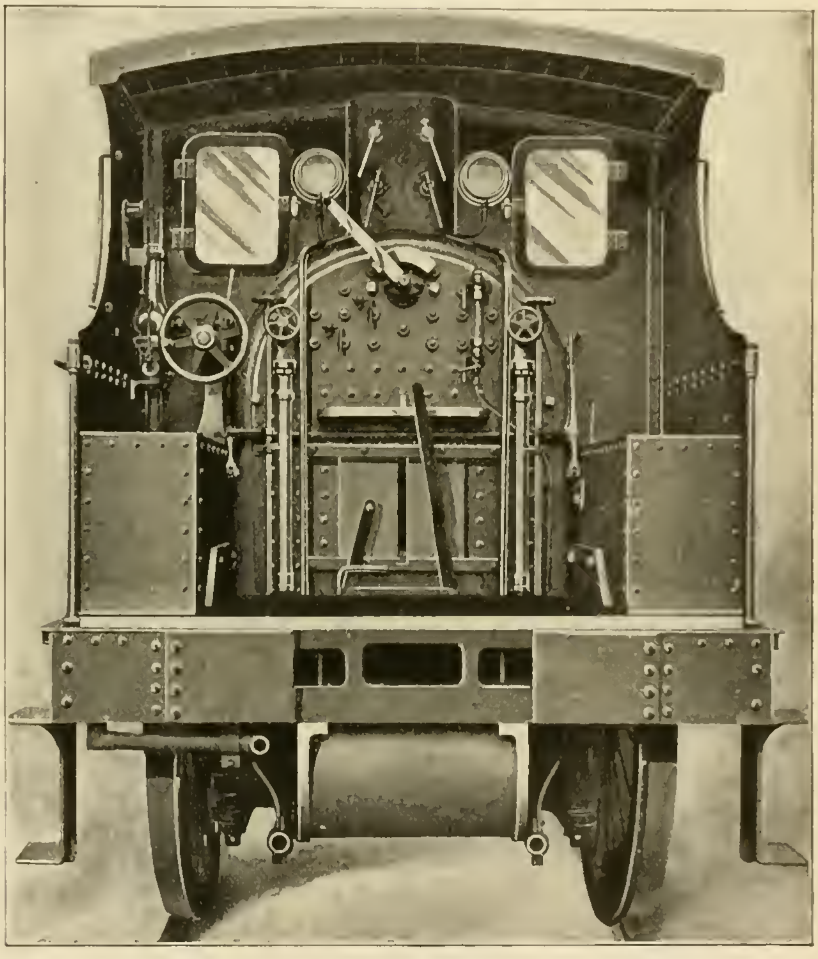
"And the regular cans?"

"From 45 to 70 cents, according to quality."

"And you, a man in charge of an important department, advise me to spend a dollar extra for each oil can on the road, just to prevent careless oiling by your engineers?"

"Well, hardly that. I ran an engine on this road for more than ten years. I know it is impossible to oil around with a plain can without wasting *some* oil, especially in getting can to and from awkward places like the links, eccentrics and truck boxes."

"Mr. Skeevers," said the new general manager, with a cynical smile, "this is not the Pennsylvania. We have no money to burn on fads and nickel-plated notions."



BOILER HEAD OF BRITISH LOCOMOTIVE.

The new general manager looked at a card his clerk handed him, and added:

"I shall take up this matter of extravagance in oil personally; in fact, I have already done so—tell him to come in."

Skeevers decided that he was dismissed, and he took his temper and his oil cans back to the shop. On the way to his office he went through the roundhouse, and noticed an indignation meeting of engineers in front of the bulletin board.

The new general manager had posted a red-hot notice about oil economy with a stinger in every line of it. This was not the first time the new general manager had gone over his head in things mechanical.

Skeevers went to his office and wrote three letters; here they are:

"Mr. H. I. Toping, G. M., G. A. L. Ry.:

"Please accept my resignation, to take effect at 6 P. M. this day and date."

"Mr. Jno. Davis, Pres., Davis Manufacturing Company:

"I will accept your offer, and assume duties the first. Hope I can please you."

"Mr. Robt. McVicar, 516 Equitable Bldg., Denver, Col.:

"Your oil can is the best one in every way that I have ever tried. No mechanic who has used an oil can can help seeing its advantages. The new general manager of the G. A. L. won't buy anything that will save money; he wants the men to do that. I shall use your can, in a limited way, in a new field which I enter next week. You might call on Mr. Toping, but wear an overcoat—you will get a frost. Wishing you success, I am, yours very truly,

"JAMES SKEEVERS."

The Russian Locomotive Works at Sormovo.

There is so much American about this locomotive works, the tools, the leading mechanical engineers, etc., that it has a peculiar interest in addition to the fact of its being in a far-away country. The upper and lower views show the bridge of the traveling crane being lifted into position by the use of the single mast and rope tackle. This makes a very good plan where head room is limited.

The upper picture shows the bridge nearly in position, the American tools at the left, and the leading spirit of the enterprise, also American, in the shape of Mr. W. F. Dixon, the chief engineer of the locomotive department of the great works at Sormovo.

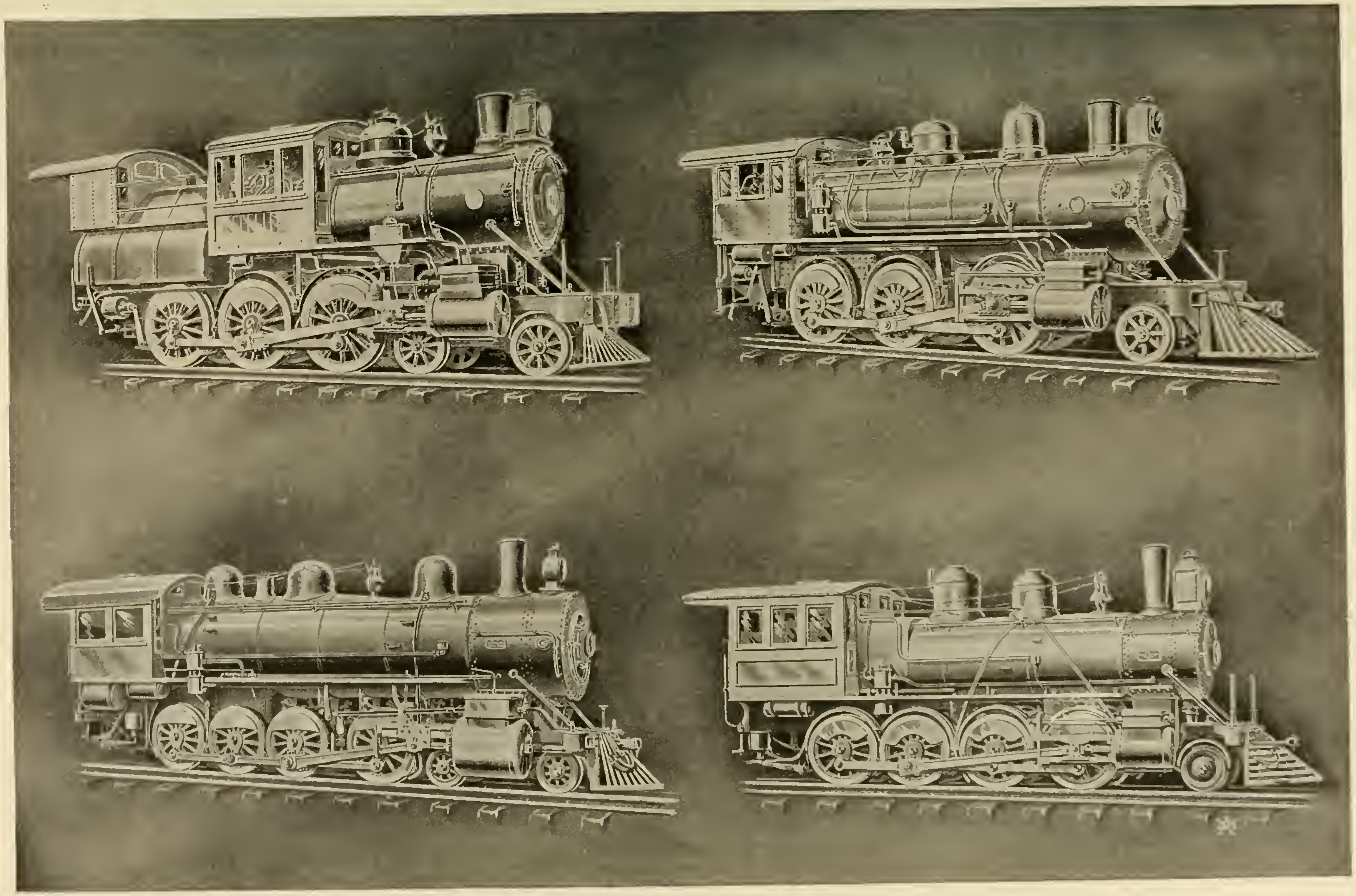
The lower view shows the power used, in the shape of a man-propelled capstan, which does the work when you get enough men at it. These views also give an idea of the construction of the buildings, which are evidently well lighted.

The middle view shows the same method being employed to put the boiler-house stack into position, it being placed in two pieces and afterwards joined.

The photographs were taken and sent to us by Mr. Henry H. Stevens, son of the general foreman, and we hope to have other views showing the progress of locomotive building in Russia from time to time.

Both American and European capital have been secured to build a 45-mile railway between Puerto Plata and Santiago, in the Dominican Republic. While this seems rather insignificant to us, 45 miles means considerable to an island like San Domingo, particularly when it runs crosswise of the island.

SORMOVO LOCOMOTIVE WORKS, RUSSIA.



Ten-wheeler. Mogul.
Twelve-wheeler. Consolidation.

GRAPHIC HISTORY OF THE LOCOMOTIVE.
Twelve Charts. Chart No. 11,
REPRESENTATIVE AMERICAN FREIGHT LOCOMOTIVES.

The "Composite" Car.

We illustrate with two engravings a steam motor car recently built for the New England Railroad by the Schenectady Locomotive Works, one giving a view of the motor alone, the other showing it applied to the car. The purpose of building this motor was to provide cheap means of moving small bodies of passengers, so that frequent service could be given at small expense, thereby enabling the railroad company to compete with electric cars for suburban service. It is a move to arrest the taking away of steam railroad passenger business by street car lines.

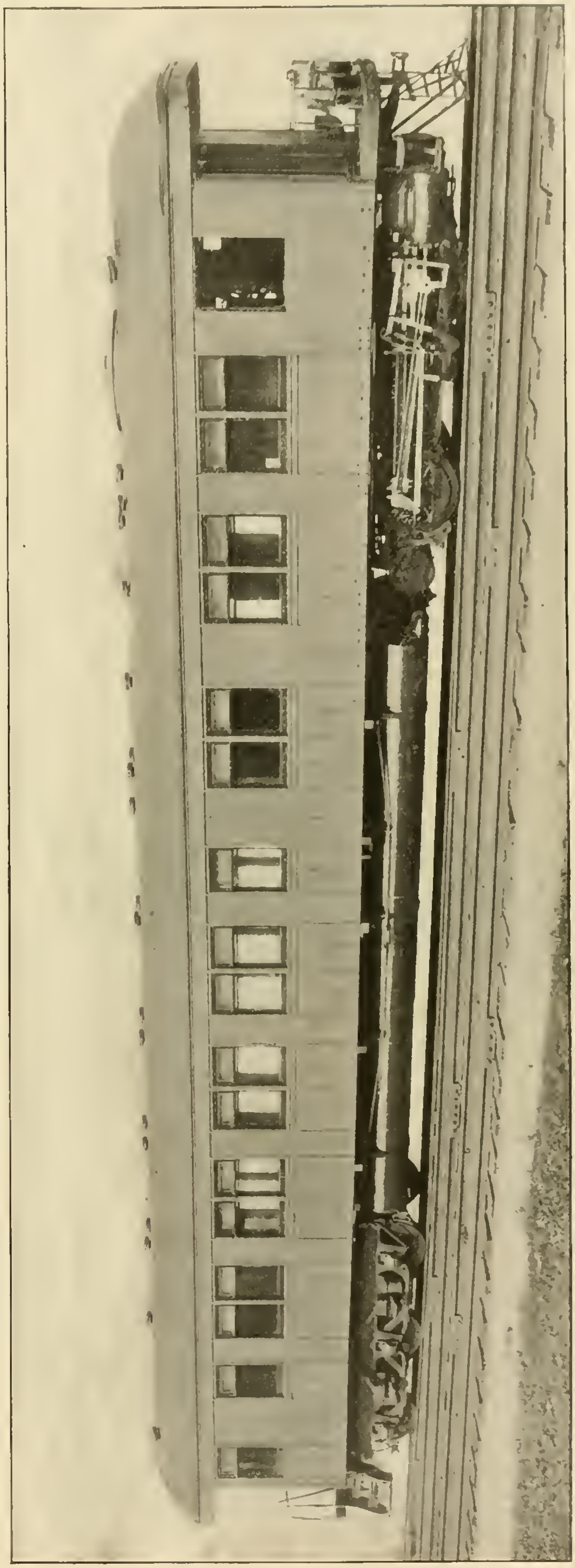
We consider it the most important advance made in steam motive power equipment for many years, and strangely enough it originated, not with a railroad mechanic or locomotive designer, but with Mr. C. Peter Clark, president of the New England Railroad. Mr. Clark presented to the Schenectady Locomotive Works, as he had previously submitted to other locomotive builders, the problem of building a car for service on some of the branches of his road where the traffic does not warrant a full equipment of two or three cars and a crew of four or five men. The "composite" was built to meet this requirement, and is considered highly satisfactory. Mr. Clark is enthusiastic in his praise of the work done by the Schenectady Locomotive Works people. The car seats sixty passengers, and is operated by two men.

The engravings give a very clear idea of the construction of the locomotive and how it is applied to the car. The engine has cylinders 12 x 16 inches, and the drivers are 42 inches diameter. The boiler carries a working pressure of 200 pounds. This represents considerable power. Figured by the railway master mechanics' formula, the maximum tractive power is over 9,000 pounds.

On a trial trip up a grade varying from 50 to 58 feet to the mile, three miles in length, the car maintained a speed of thirty miles per hour, hauling a regular passenger coach as a trailer; while on a level, the car alone, with a quarter-mile start from the first mile post, covered five successive miles in 5 minutes 55 seconds, as follows:

1st mile, 1 minute and 20 seconds.
2d mile, 1 minute and 10 seconds.
3d mile, 1 minute and 5 seconds.
4th mile, 1 minute and 7 seconds.
5th mile, 1 minute and 13 seconds.

As will be seen by the engravings, the boiler is surrounded by a circular casting on which is a groove in which rest about 125 1½-inch hardened steel balls. A corresponding casting is attached to the framing of the car, resting upon these balls, which allows the locomotive to swivel freely in passing curves, the same as an ordinary truck. The steam and exhaust pipe connections pass from the boiler to the cylinder *inside* of this ball



NEW ENGLAND RAILROAD STEAM MOTOR CAR.

run-way, so that these are made rigid, and there are no flexible steam joints. Every detail of the motor is wonderfully well worked out. Compressed air is used for whistling, for ringing the bell and for shaking the grates. The motion is arranged with a view to each part being easily reached, and the Walschaert valve motion employed makes that part very compact.

The fuel used in car is coke or anthracite coal, and the car has sufficient fuel and water capacity to enable it to run sixty miles without replenishing it.

An Efficient Tie-Plug Machine.

The tie plug cuts no small figure in the maintenance of permanent way, in plugging up old spike holes in ties, but for which care a tie would soon be fit for the pyre at the track side, all on account of the decay invited and fostered by water collecting in the little holes left by the withdrawal of spikes from a tie.

At the Brainerd shops of the Northern Pacific, Mr. S. L. Bean, master mechanic, they have devised a machine for making these plugs at a trifling cost. The machine consists of an ordinary saw table, 20 inches wide and 6 feet long, fitted with two arbors, on one of which are ten No. 13 gage saws used for ripping the material, and the other having eleven knives used for pointing the plugs.

The material is passed over the pointing knives from two sides, which operation cuts v-shaped grooves across the block both ways, making a chamfered point. After any number of pieces are thus treated, the blocks are passed over the gang saws in the two directions, for which purpose a small iron table is used which slides upon the machine table, the saws having an adjustment so as to come within ¼ inch of the block's thickness and leaves the plugs joined together by that amount of material, making them convenient to store and handle, and also easy to pull apart by the section men.

With this machine they are enabled to use up all oak scraps from car timbers, bridge ties, etc., that are four feet long or over. The machine has been in operation about three months, during which period it has turned out 3,000,000 plugs. one man and helper easily making 45,000 plugs a day.

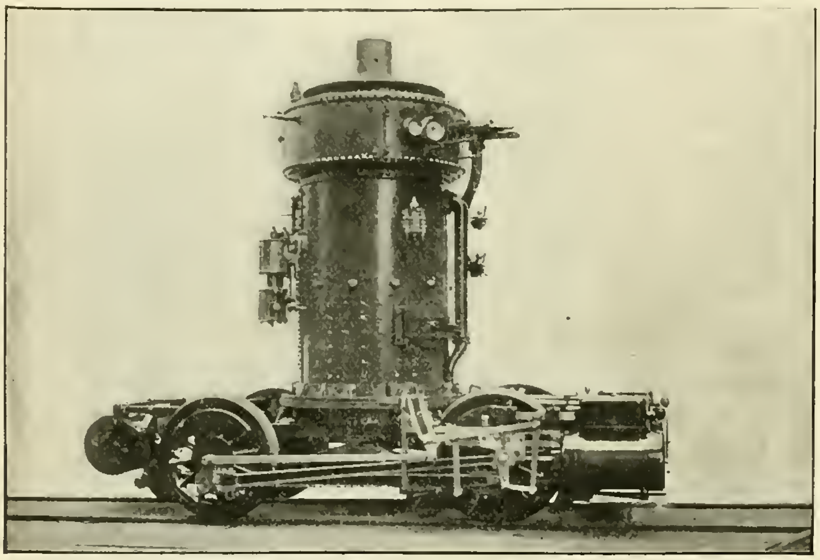
A "Down Hill" Railroad.

That all the decided departures in railroading are not dreamed of on this side of the water is shown by the Halford Aerial Railway, which is now attracting the attention of English railway men. The "Railway Engineer," of London, describes it as follows:

"The lines are raised at any convenient hight above the ground, in order that the cars, which are suspended on pivots attached to a bogie, may clear the ground. The line consists of girders resting at both ends on hydraulic rams. When the train is ready to start one end of the girder on which it is standing is raised and the train runs down, and as it approaches the other end of the girder its weight depresses it and automatically turns on the pressure into the hydraulic cylinder, which begins to rise immediately the train has passed. In a full-sized train the working of the hydraulic cylinders would be controlled from the cars by means of electricity. The inventor claims that a speed of 200 miles an hour could be safely attained and maintained. The novelty of this invention is startling, and its ingenuity remarkable. The model, which was about 7 yards long, and had a straight and level line, worked quite satisfactorily."

This may be all right on a seven-yard straight line, but how about curves and long lines? Unless the cars are lifted bodily at frequent intervals it is difficult to see where the "down hill" part comes in. It appears to be another form of the old gravity road plan, with the addition of making the grade to suit by raising one end of the track.

It reminds us somewhat of the Hibernian who went to hire a horse at a livery stable, where the only available animal was in a rather dilapidated condition. "Never moind," said Pat, "the road is down hill all the way." "But how is it coming home?" asked the proprietor. "Jist about the same, sor," was the reply. With this kind of a road Mr. Halford's scheme might work to perfection, but we do not anticipate any adoption of a plan to raise trains bodily to obtain speed by gravity.



ENGINE AND BOILER OF NEW ENGLAND RAILROAD STEAM MOTOR CAR.

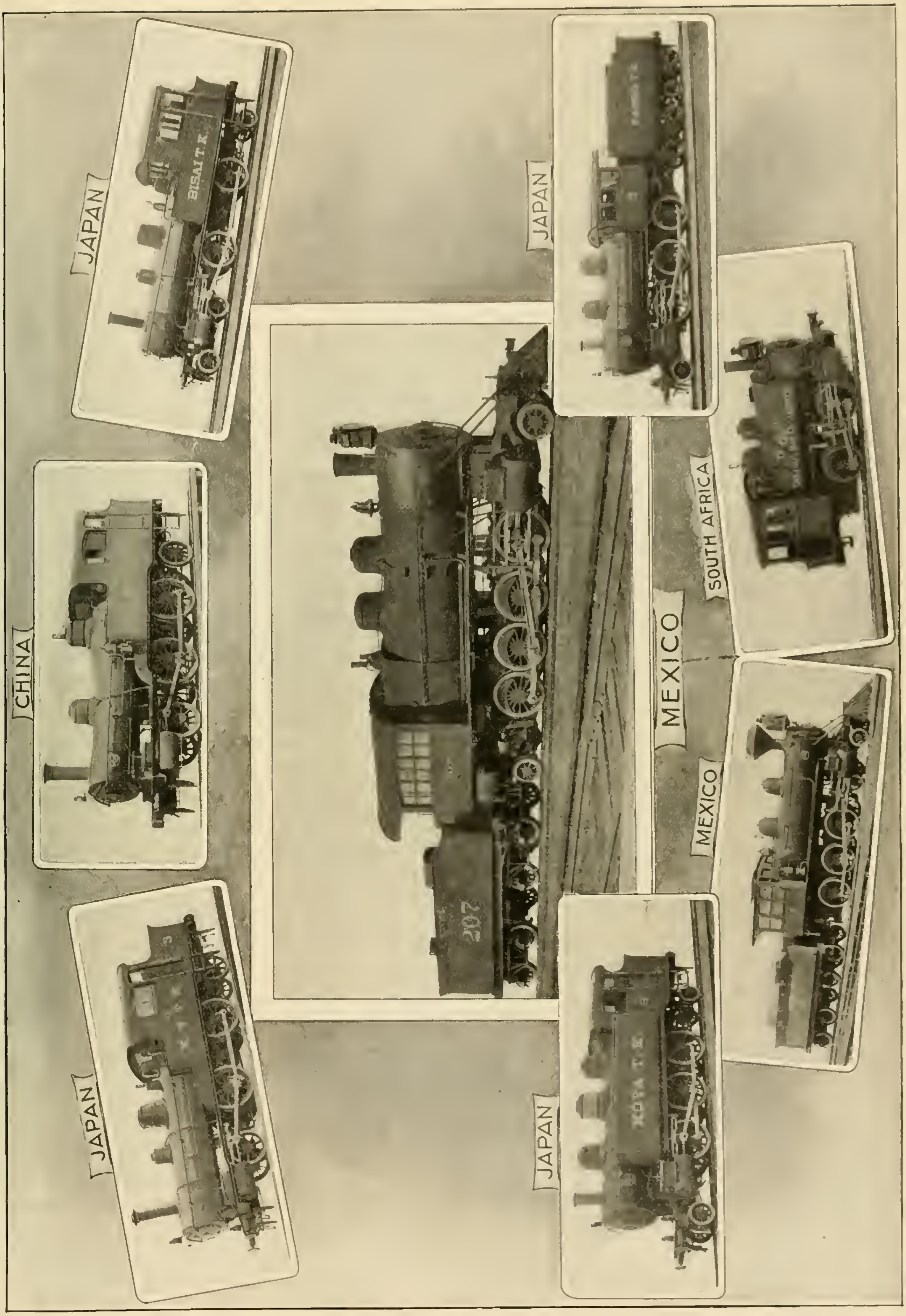
The Smallest Locomotive in Train Service.

The photograph of the very small engine hereby shown was kindly sent to us by Mr. E. W. Gregory, of New York. Concerning the engine he writes: "It is one of the five in use on the Sea View Elevated at Coney Island. They run about five months in the Summer, and are, I think, the smallest standard gage passenger locomotives in actual operation. Their cylinders are 7x10 inches inside of frame, as are the cranks in the intermediate shafts. They have a slide throttle valve on the top of dome and outside steam pipes. They haul one or two coaches as travel demands.

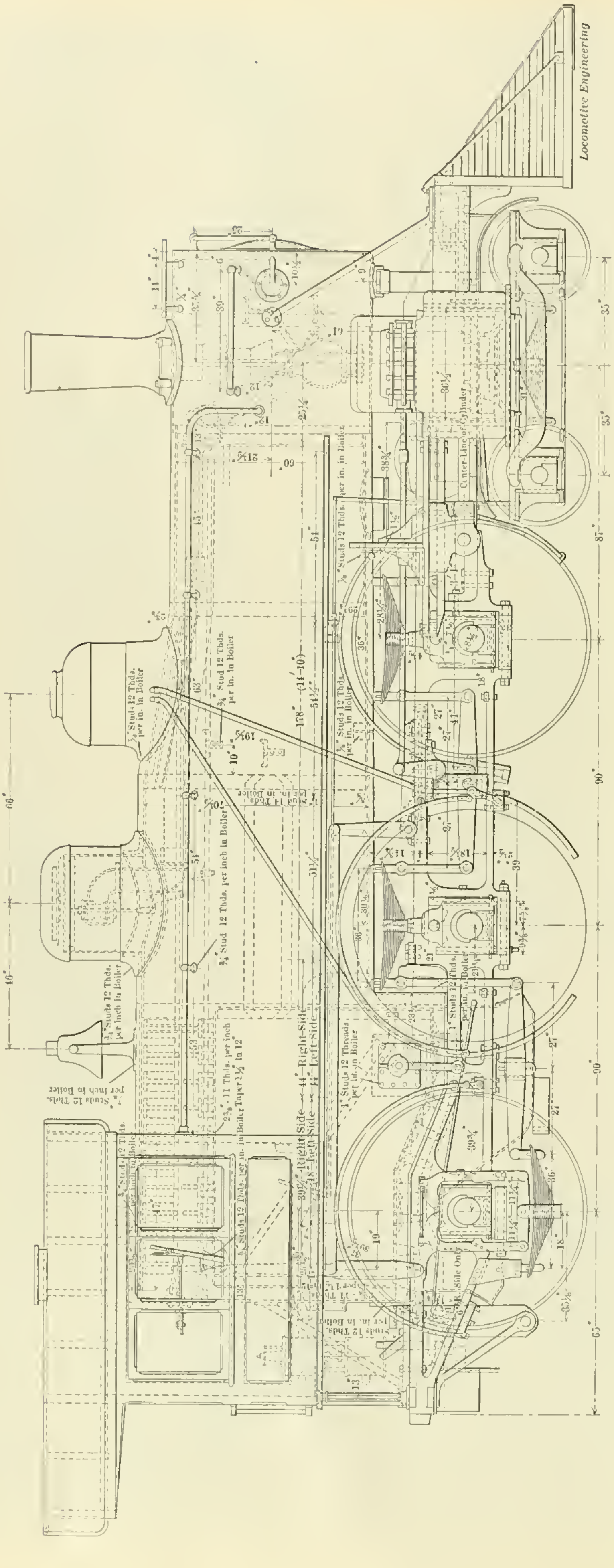
SMALLEST LOCOMOTIVE.

"These engines were originally built for the old Greenwich Street Elevated Railroad of New York, and are probably the oldest elevated railroad engines in the country."

A movement is on foot to build a railway in the Malay Peninsula. A large loan has been approved, as well as plans for 370 miles of railway, which, it is expected, will be in operation by 1903. Work is said to have begun on one section of the line.



FOREIGN LOCOMOTIVES RECENTLY BUILT AT THE BROOKS LOCOMOTIVE WORKS.



DICKSON TEN-WHEELER FOR ATCHISON, TOPEKA & SANTA FE.

Ten-Wheeled Passenger Engine—Atchison, Topeka & Santa Fe Railway.

Some new ten-wheel passenger engines have recently been built for the Atchison, Topeka & Santa Fé Railway, by the Dickson Locomotive Works, and our engraving representing a side elevation of the engines conveys to the mechanical mind a very clear idea of what the machines are like.

The top of the rear section of the frame is sloped to carry the inclined firebox, which is seen to have a good depth from the top of grate to the bottom row of tubes, and with the 4-inch water spaces at the mud ring, and the water tubes supporting the brick arch, shows a design evidently meant to cope with water not of the best. In connection with bad water, attention may be directed to the crown-sheet staying, which consists of T-section crown bars resting on thimbles 4 inches high, giving a liberal space above crown for washing out. The staying system is the standard of the road.

Spring suspension at the rear drivers, which is peculiar to the Dickson Locomotive Works, appears to have some advantages over many other devices for underhung springs, in that the driving-box cellar is easily removed without interfering with the spring rigging, and the same may be said of the removal of the pedestal braces. Pin joints are used exclusively between the spring hangers and equalizers, which should make the engine sensitive to a high or low spot on the rail, equalizing easier and riding smoother than with rigid gib connections at both ends of the hangers.

A new location is shown for the air pump, which is seen on the left-hand side, under the fireman's seat, the steam cylinder passing up through the running board, and the covering for same forming the seat for the fireman. In this position it is believed to be easier of access than when placed forward of the cab, or under the waist, and handier to work on or around; in any event, it is out of the way of everything, except a broken side rod.

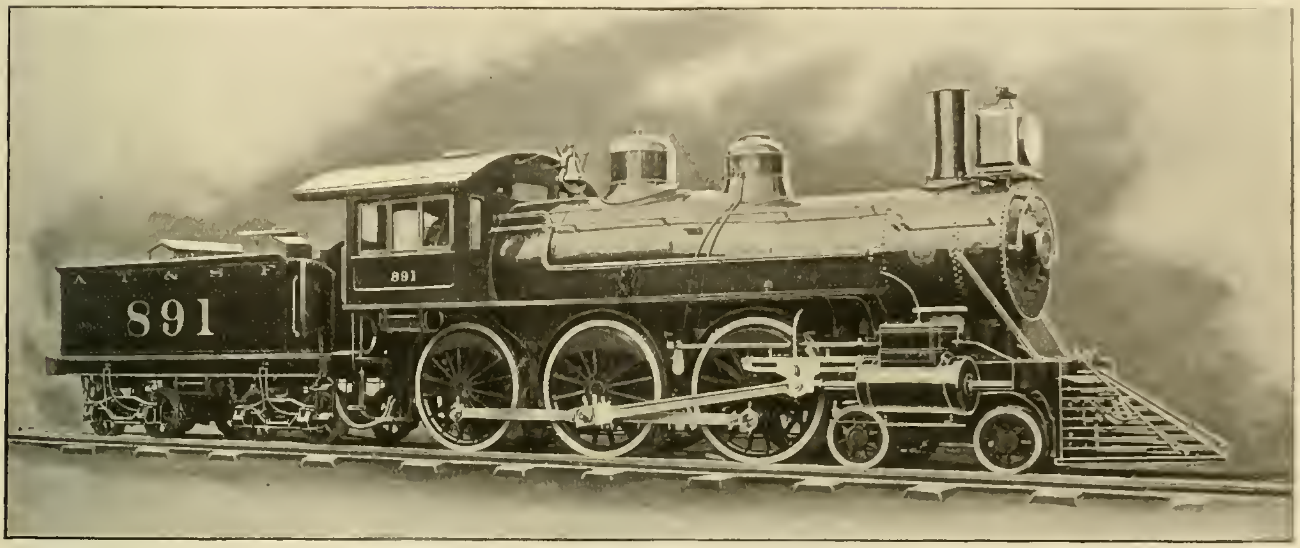
The valve rod is necessarily long in order to get a normal length of eccentric rod; but no buckling effects can ensue from this cause, as the rod is made to pass through the guide yoke and bracket by bushing the latter; the distance from the rocker arm to the bushed bearing being sufficient to prevent binding due to the vibrations of the rocker.

The service exacted from these engines is of a character demanding a powerful machine, the train consisting of twelve heavy cars, and the division on which they run having an average gradient of 52.8 feet per mile. To meet these conditions there is provided a starting draw-bar pull of 21,200 pounds. General dimensions of the engine are as below:

Type of engine—Ten-wheeled.

Fuel—Bituminous coal.

Cylinders, diameter—19½ inches.
Pistons, stroke—28 inches.
Piston rod, diameter—3¾ inches.
Piston-rod packing—Jerome metallic.
Valves—Richardson balanced.
Driving wheels, diameter—73 inches.
Truck wheels, diameter—30 inches.
Weight on drivers—110,000 pounds.
Weight on truck—30,000 pounds.
Total weight of engine—140,000 pounds.
Rigid wheel base—15 feet.
Total wheel base—25 feet 2 inches.
Length of engine and tender—55 feet.
Boiler, type—Extended wagon top.
Working pressure—180 pounds.
Journals, truck axles—5½ inches by 10 inches.
Main crank pins—6 inches diameter, 6 inches long, 6¼ inches diameter, 5 inches long.
Front and back crank pins—5½ inches diameter, 3¾ inches long.
Smokebox, diameter—63 inches.
Smokebox, length—61 inches.
Smokestack, smallest diameter—14½ inches.
Exhaust nozzle, kind—Single.
Sand blast, kind—Houston.
Feed-water heater—Rushforth.
Blow-off cock—Reed's cyclone.



DICKSON TEN-WHEELER FOR ATCHISON, TOPEKA & SANTA FE.

Diameter of boiler, small ring—60 inches outside.
Thickness of material in boiler—½, 9-16 and ⅝ inch.
Horizontal seams—Quadruple-riveted butt joints.
Circumferential seams—Double riveted.
Diameter of dome—30 inches.
Firebox, length—88 inches.
Firebox, width—42 inches.
Firebox, depth at front—64½ inches.
Firebox, depth at back—58 inches.
Brick arch support—On tubes.
Thickness of tube sheets—½ inch, front; 9-16 inch, back.
Thickness, side and back sheets—⅜ in.
Thickness crown sheet—½ inch.
Crown sheet stayed with the Player crown bar and stay.
Grate bars—Cast-iron, shaking.
Tubes, number—264.
Tubes, diameter—2 inches.
Tubes, length—14 feet 10 inches.
Tubes, gage—No. 11 W. G.
Heating surface in tubes—2,049.5 square feet.
Heating surface in firebox—146.5 square feet.
Heating surface, total—2,196 square feet.
Grate area—25.5 square feet.
Journals, driving axles—8½ inches by 10 inches.
Tender frame—Steel, 9 inches deep.
Tender truck wheel, kind—Standard wrought-iron center with steel tire.
Tender truck wheel, diameter—30 inches.
Tender truck axle—4¼ inches diameter by 8 inches long.
Tank, capacity for water—4,650 gallons.
Length of tank—19 feet 9 inches.
Width of tank—9 feet 1 inch.
Hight of tank cistern—4 feet 8 inches.

Rich Ladies Get Engineer Into Trouble

A press dispatch recently sent out from San Francisco reads:

"When coming across the continent recently, Mrs. Herman Oelrichs and Miss Virginia Fair accepted the invitation of Engineer Sholl, of the Central Pacific, to ride in the cab of the engine from Promontory to Terrace, a stretch of road noted for its scenic beauty. The rules of the company are against the extension of such privileges as riding on the engine to passengers, unless a special permit is produced, so the engineer was suspended for forty days for disobedience of rules. On learning of this order, Mrs. Oelrichs telegraphed to Sholl to come to San Francisco. He arrived here on Thursday, and it is reported that his unauthorized hospitality is to be handsomely rewarded."

The Telegrams Got Mixed.

A correspondent of the Westminster "Gazette," writing of a distorted French telegram, tells a story which he got from Lord Onslow on his return from New Zealand: "Many years ago Mr. Gladstone, speaking of Mr. Parnell, made use of the oft-quoted phrase, 'Marching through rapine to the dismemberment of the empire.' On the same day there was a horse race, in which the winners were, respectively, Veracity, Tyrone and Lobster. These facts were cabled to New Zealand together in the usual shorthand style of the cable.

The result was that the next day the New Zealand papers contained the following extraordinary paragraph: 'Mr. Gladstone denounced Mr. Parnell as marching through rapine to the dismemberment of the empire, and said that the Irish leader had the veracity of a Tyrone lobster.' "

The library of the Railroad Branch of the Young Men's Christian Association, 361 Madison avenue, New York, has got out a very neat little catalog of the books in their library that are most useful to locomotive engineers and firemen. All the books mentioned are standard works of their kind, and all are well worthy of study.

An English electrical engineer, Mr. E. Tremlett Carter, recently inspected the electrical equipment of the Baltimore & Ohio, at Baltimore, as the London Underground Railway has adopted the same style of motors used in the Baltimore tunnel. Mr. Carter declared it the most complete and economically handled plant he had ever seen and said he had never been in a tunnel that was so absolutely free from smoke.

The Highest Train Speed Ever Maintained Regularly.

In the last issue of "Locomotive Engineering" appeared a letter from Vice-President Voorhees, of the Philadelphia & Reading, congratulating Engineer Charles H. Fahl for his skill and courage in running the Atlantic City express for two months at an unprecedented rate of speed. From July 2d to August 31st the average speed of the train was 69 miles an hour. On twenty-two days the train consisted of five cars, and on thirty-one days the load was six of the heavy cars used on that road.

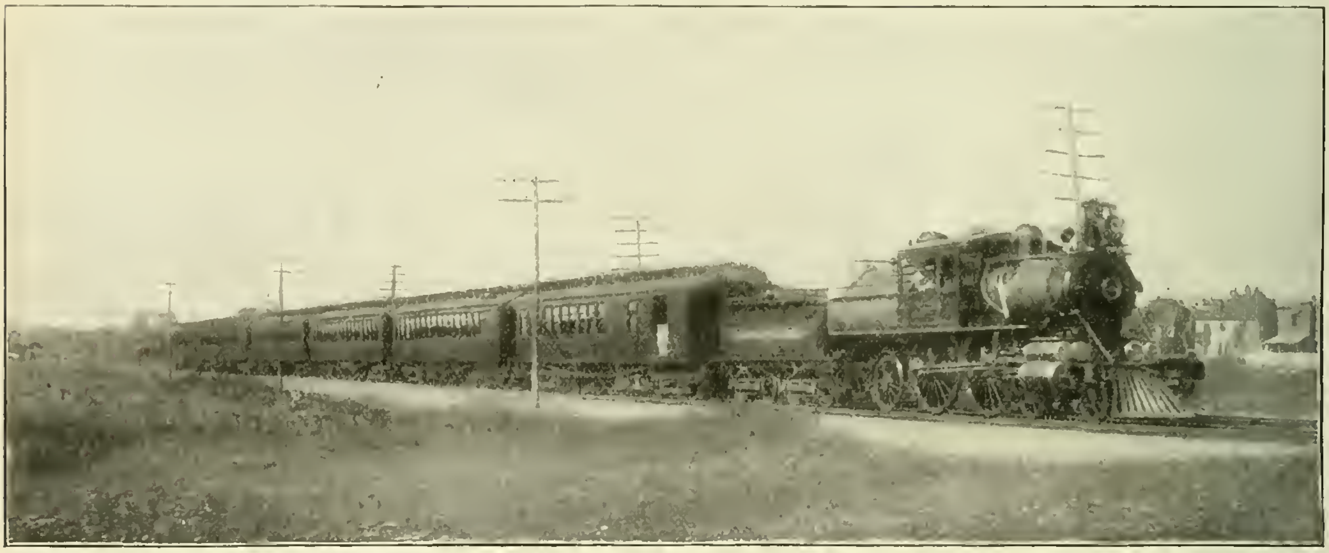
We now present an engraving showing engine and train, and a table giving particulars of each daily run. The engine, as will be seen, is a Vauclain compound which was specially built for heavy fast passenger service. The cars averaged in weight, with load, about 75,000 pounds each.

gers: "Now, all ye beggars for Chowbent, Chuckabent and Bowdene, change 'ere. T'other beggars sit still." The general manager of the company, hearing this formula as he came down the line one day, called to the porter, "What's that you're saying, my good man?" Porter, as before: "Now, all ye beggars." General manager: "Do you know who I am, my man?" Porter: "Aye, thou beest William Cawkwell, general manager, Lunnon, North-Western Railway; 'as a 'ouse in Lunnon; gets £2,000 a year for doin' nowt. Now, all ye beggars."—"Railway Herald."

The company building the New York & Ottawa Railroad, a line under construction to run between the two cities named, have made application to the railroad commission of New York for permission to cross all roads at grade. As public sentiment has been growing very strongly for years against the practice of railroads crossing each other at grade, it is earnestly to be hoped that the railroad commission will refuse to grant permission for such a dangerous practice. All over the country, railroads are going to great expense to abolish grade crossings, and it would be the hight of folly to permit a new railroad to cross other railroads at grade, in passing through the most thickly settled State in the Union.

The Illinois Central Railroad Company, which in Chicago have the finest suburban railway service in the country, have been investigating the practicability of substituting some other motive power for the locomotives now employed, but nothing has been found that would handle the heavy traffic so satisfactorily as steam. The various methods of transmitting electricity for car operating were investigated, including the electric-car service of the New York, New Haven & Hartford, but none of them were regarded as being likely to perform the work with the regularity and dispatch of the steam locomotives. The different forms of air motors were also examined, and the conclusion arrived at was that nothing is in sight that is likely to push the locomotive out of train service that is heavy and fast.

A Pan Handle correspondent writes us: "We are making some good runs on fast freight with the class of engines described in 'Locomotive Engineering' some time back, known as class F. I., P. R. R., built at the Altoona shops. They make the run from Columbus to Dennison, 100 miles, in 4 hours. They have made it over this division in 3 hours 45 minutes. The run from Dennison to Wall's, 108 miles, was done in 4 hours 30 minutes. They make this run on two tanks of water. The first 50 miles east of Dennison the grades run from 30 to 40 feet to the mile. The rest of the way the grades run 40 to 52 feet to the mile. This class of engines are rated at 735 tons."



ENGINE AND TRAIN ON THE ATLANTIC CITY RAILROAD THAT BROKE ALL PREVIOUS SPEED RECORDS.

Good Reason for Wanting a Pass.

The general passenger agent of one of the Chicago trunk lines received a letter from a Kansas man the other day requesting a pass for himself to Chicago and return. There was nothing about the letter to indicate that the writer had any claim to the courtesy he requested, but the railway man thought that perhaps the Kansan had some connection with the road, possibly as a local freight agent. So he wrote back:

"Please state explicitly on what account you request transportation."

By return mail came this reply:

"I've got to go to Chicago some way, and I don't want to walk."

The Porter and the General Manager.

The following story is told of the late Mr. William Cawkwell, whose death was lately announced: An ancient porter on the Lancashire & Yorkshire Railway had the following unique formula for passen-

In the interests of health and cleanliness, a great many street car companies have notices posted in the cars informing tobacco chewers and others that spitting on the floor is forbidden. Boston has risen to an appreciation of the merits of this sanitary regulation, but Boston street car companies do not indulge in the use of common words when expressions that sound profoundly scholarly can be employed. Their notice reads, "Deposit of sputum on the floor is prohibited."

Notice that black thread running through the wrapper on "Locomotive Engineering"—pull it—that opens the wrapper. You don't have to cut or tear it.

TIME MADE ON ATLANTIC CITY RAILROAD

JULY.

Stations.	Distance.	Sched. Time.	2d.	3d.	5th.	6th.	7th.	8th.	9th.	10th.	12th.	13th.	14th.	15th.	16th.
Camden	.0	3.48	3.50½	3.50¾	3.50½	3.50¾	3.51	3.50½	3.49½	3.49½	3.49¼	3.49	3.49½	3.50¼	3.51½
W. Collingswood	3.1	3.54	3.55	3.55	3.55	3.55	3.56	3.55	3.54½	3.54	3.54	3.54	3.54	3.54½	3.56
Haddon Heights	5.5	3.56	3.57½	3.58	3.57	3.58	3.58	3.57½	3.57	3.57	3.56½	3.56½	3.56	3.57½	3.59
Magnolia	7.9	3.58	4.00	4.00	4.00	4.00	4.00½	3.59¼	3.59½	3.58	3.59	3.58½	3.59	3.59½	4.01
Clementon	12.0	4.02	4.03	4.03½	4.03¾	4.03	4.04	4.02¾	4.02½	4.02	4.02	4.01½	4.02	4.02½	4.04
Williamstown Junction	17.0	4.06	4.07½	4.08	4.07½	4.07	4.08	4.07¼	4.06½	4.06	4.06	4.06	4.06	4.06½	4.08
Cedar Brook	19.9	4.09	4.10	4.10¼	4.10½	4.10	4.10½	4.09½	4.09½	4.09	4.09	4.08½	4.08½	4.09½	4.10½
Winslow Junction	24.5	4.12	4.13½	4.14	4.14	4.13½	4.14	4.13	4.13	4.12½	4.13	4.12½	4.12	4.13	4.14
Hammonton	27.6	4.15	4.16	4.16½	4.16½	4.16	4.16½	4.15½	4.15	4.15	4.15	4.14½	4.14½	4.15	4.17
Elwood	33.8	4.20	4.20½	4.21	4.21	4.20½	4.21½	4.20¼	4.20¼	4.20	4.20	4.19¾	4.19½	4.20	4.21
Egg Harbor	38.7	4.24	4.25	4.25	4.25	4.24	4.25	4.24½	4.24	4.24	4.24	4.24	4.23½	4.23½	4.24½
Brigantine Junction	43.5	4.28	4.28½	4.29½	4.29	4.28	4.20	4.28	4.28	4.28	4.28	4.27	4.27	4.27	4.28½
Pleasantville	50.5	4.33	4.34½	1.35	4.34	4.34	4.35	4.33	4.33	4.33	4.33½	4.33	4.32	4.33	4.34¼
Meadow Tower	53.8	.....	4.37	4.37	4.37	4.36½	4.37	4.35½	4.36	4.36	4.36	4.35½	4.34½	4.35	4.36½
Atlantic City	55.5	4.40	4.38½	4.38½	4.38	4.37¾	4.38½	4.37½	4.37½	4.37½	4.37½	4.37	4.36	4.39	4.38½
Number of cars	.....	.....	5	5	5	6	5	5	6	6	5	5	5	5	5
Running Time	.....	.....	.48	.47¾	.47½	.47	.47½	.47	.48	.48	.48¼	.48	.46½	.48¾	.47
Miles per hour (average)	.....	.....	69.3	69.7	70.1	70.8	70.1	70.8	69.3	69.3	69.0	69.3	71.6	68.3	70.5

Stations.	Distance.	Sched. Time.	17th.	19th.	20th.	21st.	22d	23d	24th.	26th	27th.	28th.	29th.	30th.	31st
Camden	.0	3.48	3.51½	3.51	3.51	3.50¾	3.50	3.49½	3.49	3.49	3.49½	3.48¾	3.49	3.49	3.50
W. Collingswood	3.1	3.54	3.55½	3.55	3.55½	3.56	3.55	3.54	3.54	3.54	3.54	3.53½	3.53½	3.54	3.55
Haddon Heights	5.5	3.56	3.58½	3.58	3.58	3.58	3.57	3.56½	3.57	3.56½	3.56½	3.56	3.56	3.57	3.57½
Magnolia	7.9	3.58	4.01	4.00	4.00	4.00½	3.59½	3.59	3.59	3.59	3.59	3.58	3.58½	3.59	3.59½
Clementon	12.0	4.02	4.04	4.03	4.03	4.03½	4.02	4.02	4.02	4.02	4.02	4.01	4.01½	4.02	4.03
Williamstown Junction	17.0	4.06	4.08½	4.07	4.07½	4.07½	4.06	4.07	4.06	4.06	4.06	4.06	4.06	4.06	4.07
Cedar Brook	19.9	4.09	4.11	4.09½	4.09¾	4.10½	4.09	4.09	4.09	4.09	4.09	4.08	4.08½	4.09	4.09½
Winslow Junction	24.5	4.12	4.15	4.13	4.13	4.14	4.12½	4.12½	4.12½	4.12½	4.12¾	4.11¾	4.12	4.12½	4.12½
Hammonton	27.6	4.15	4.17½	4.15½	4.16	4.16½	4.15	4.15	4.15	4.15	4.15½	4.14	4.14½	4.15	4.15
Elwood	33.8	4.20	4.22	4.20	4.20½	4.21	4.19¾	4.20	4.19½	4.20	4.20	4.19	4.19	4.19¼	4.20
Egg Harbor	38.7	4.24	4.26	4.24	4.24	4.25	4.23½	4.24	4.24	4.24	4.24	4.23	4.23	4.23	4.23½
Brigantine Junction	43.5	4.28	4.29½	4.27½	4.28	4.29	4.27	4.27½	4.27	4.27½	4.28	4.27	4.26½	4.26½	4.27½
Pleasantville	50.5	4.33	4.35¼	4.32½	4.33½	4.34¾	4.32¾	4.33	4.32½	4.33	4.33½	4.32½	4.32½	4.32	4.33
Meadow Tower	53.8	.....	4.37½	4.35½	4.36	4.37	4.35½	4.36	4.35	4.36	4.36	4.35½	4.35	4.35	4.35½
Atlantic City	55.5	4.40	4.39½	4.38	4.38	4.38½	4.37½	4.38	4.38	4.39	4.38½	4.38	4.38	4.37	4.38
Number of cars	.....	.....	6	5	5	5	5	6	6	5	5	5	6	6	6
Running Time		.....	.48	.47	.47	.47¾	.47½	.48½	.49	.50	.49	.49¼	.49	.48	.47
Miles per hour (average)	.....	.....	69.3	70.8	70.8	69.7	70.1	68.6	67.9	66.6	67.9	67.6	67.9	69.3	70.8

AUGUST.

Stations.	Distance	Sched. Time.	2d	3d.	4th.	5th.	6th	7th.	9th.	10th.	11th	12th.	13th.	14th.	16th.
Camden	.0	3.48	3.51¾	3.51½	3.51½	3.50½	3.50¼	3.49½	3.50¼	3.50½	3.49¾	3.50	3.50¼	3.51¼	3.51½
W. Collingswood	3.1	3.54	3.56	3.56½	3.56	3.55½	3.55	3.54	3.55	3.55½	3.54½	3.55	3.55	3.56	3.56
Haddon Heights	5.5	3.56	3.59	3.59	3.59	3.58½	3.57½	3.56½	3.57½	3.58	3.57	3.57	3.57½	3.58½	3.59
Magnolia	7.9	3.58	4.01	4.01	4.01	4.02	3.59½	3.59	3.59½	4.00½	3.59½	3.59½	3.59½	4.01	4.01
Clementon	12.0	4.02	4.04	4.04½	4.04	4.03½	4.03	4.02	4.02½	4.03½	4.02¼	4.02¼	4.03	4.04	4.04¼
Williamstown Junction	17.0	4.06	4.08½	4.08½	4.08½	4.07½	4.07¼	4.06	4.07	4.08	4.07	4.06½	4.07	4.08	4.08¾
Cedar Brook	19.9	4.09	4.11	4.11	4.11	4.10¼	4.09½	4.09	4.09½	4.10½	4.09	4.09	4.09½	4.11	4.11
Winslow Junction	24.5	4.12	4.14½	4.15	4.14½	4.13½	4.13	4.12½	4.12½	4.14	4.12½	4.12½	4.13½	4.14½	4.14¾
Hammonton	27.6	4.15	4.17	4.17	4.17	4.16	4.15	4.15	4.15	4.16½	4.15	4.15	4.15½	4.17	4.17
Elwood	33.8	4.20	4.21½	4.21¾	4.21½	4.20½	4.20	4.20	4.20	4.21¼	4.19½	4.20	4.20	4.21½	4.21½
Egg Harbor	38.7	4.24	4.25	4.25	4.25	4.24	4.24	4.24	4.23½	4.24½	4.23	4.24	4.23½	4.25	4.25½
Brigantine Junction	43.5	4.28	4.29	4.29¼	4.29	4.28	4.27	4.27	4.27	4.28	4.27	4.27	4.27½	4.29	4.29
Pleasantville	50.5	4.33	4.34	4.34½	4.34½	4.33	4.33	4.33	4.33	4.34	4.32½	4.33	4.33	4.35	4.34½
Meadow Tower	53.8	.....	4.36¾	4.37¼	4.37	4.36	4.35½	4.35½	4.35½	4.37	4.35	4.35½	4.35½	4.37½	4.37½
Atlantic City	55.5	4.40	4.38½	4.39	4.39½	4.38½	4.37½	4.37½	4.38	4.38½	4.37¾	4.38	4.37¾	4.39¼	4.39¼
Number of cars	.....	.....	6	6	6	6	6	6	5	6	6	6	6	6	6
Running Time	.....	.....	.46¾	.47½	.48	.48	.47¼	.48	.47¾	.48	.48	.48	.47½	.48	.47¾
Miles per hour (average)	.....	.....	71.2	70.1	69.3	69.3	70.4	69.3	69.7	69.3	69.3	69.3	70.1	69.3	69.7

Stations.	Distance	Sched. Time.	17th.	18th	19th.	20th.	21st.	23d.	24th.	25th.	26th.	27th.	28th.	30th.	31st.
Camden	.0	3.48	3.51½	3.51¼	3.51½	3.51	3.51¾	3.49½	3.49½	3.49½	3.49½	3.49¾	3.49½	3.50¼	3.51
W. Collingswood	3.1	3.54	3.56	3.56	3.55½	3.56	3.57	3.54	3.54	3.54	3.54	3.55	3.54	3.55	3.55
Haddon Heights	5.5	3.56	3.58½	3.58	3.58	3.58½	3.59	3.56½	3.57	3.56½	3.56½	3.57½	3.57	3.57½	3.58
Magnolia	7.9	3.58	4.01	4.00½	4.00½	4.01½	4.01½	3.59	3.59	3.59	3.59	4.00	3.59	3.59½	4.00
Clementon	12.0	4.02	4.04	4.03¾	4.04	4.04	4.04¾	4.02½	4.02	4.02	4.02	4.03	4.02	4.02½	4.03
Williamstown Junction	17.0	4.06	4.08	4.08	4.08	4.08	4.09	4.06½	4.06	4.06	4.06	4.07	4.06	4.06½	4.07
Cedar Brook	19.9	4.09	4.10½	4.10½	4.10½	4.10½	4.12	4.09	4.09	4.08¾	4.09	4.09½	4.09	4.09	4.10
Winslow Junction	24.5	4.12	4.14	4.13¾	4.14	4.13½	4.15	4.13	4.12½	4.12½	4.12½	4.13	4.12	4.12½	4.13½
Hammonton	27.6	4.15	4.16½	4.16½	4.16½	4.16	4.17½	4.15	4.14½	4.14½	4.14½	4.15½	4.14½	4.15	4.15½
Elwood	33.8	4.20	4.20½	4.20½	4.21	4.20½	4.22½	4.19½	4.19½	4.19	4.19½	4.20	4.19	4.19½	4.20
Egg Harbor	38.7	4.24	4.24½	4.24½	4.25	4.24	4.26	4.23½	4.23	4.23	4.23	4.24	4.23	4.23	4.24
Brigantine Junction	43.5	4.28	4.28	4.28¼	4.28½	4.27¾	4.30	4.27	4.27	4.26¾	4.27	4.27½	4.26½	4.26¾	4.27¾
Pleasantville	50.5	4.33	4.33½	4.34	4.34½	4.33	4.35½	4.32½	4.32	4.32½	4.32½	4.33½	4.31½	4.32	4.33
Meadow Tower	53.8	.....	4.36½	4.36¼	4.36½	4.35	4.38	4.35	4.35	4.35	4.35½	4.36	4.34	4.35	4.36
Atlantic City	55.5	4.40	4.38¼	4.38¾	4.38½	4.37¾	4.40	4.38	4.38	4.38½	4.38½	4.38½	4.37¾	4.38	4.37¾
Number of cars	.....	.....	6	6	6	6	6	6	6	5	6	5	6	5	5
Running Time	.....	.....	.46¾	.47½	.47	.46¾	.48¼	.48½	.48½	.49	.49	.48¾	.48¼	.47¾	.46¾
Miles per hour (average)	.....	.....	71.2	70.1	70.8	71.2	69.0	68.6	68.6	67.9	67.9	68.3	69.0	69.7	71.2

Engineer, Fahl. Conductor, Stokes.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

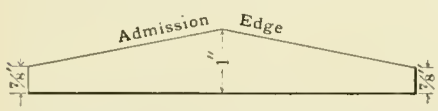
The Lehigh Valley Ten Wheeler.

Editors:

The curious old ten-wheeler which was illustrated on page 749 of October "Locomotive Engineering" was an old Mason, and was built in 1870 or 1871. They had about fifty of them in all, the only difference being that those built before 1866 had a straight boiler, instead of the wagon top as shown in the picture. I presume they have a number of these still in service between Wilkesbarre and Waverly.

The first one that came with a wagon-top boiler, as shown, was No. 125, and was named "Wyalusing." This and her mate, the No. 126 (the "Wysauking") were put on the road in the summer of 1869, and I doubt if any engines of their weight ever did more work and cost less to keep up than these. They used to run the express freights, and could also handle any passenger train then on the road on schedule time.

Their steam ports were 15 inches long, and made as shown in the sketch, being



PECULIAR FORM OF PORT.

⅞ inch wide at the ends and 1 inch wide in the center, the angle side being the admission edge of the valve. The valve had ⅞-inch outside lap and 1-32-inch inside lap, with a travel of 4¾ inches. I trust this will be of sufficient interest to Mr. Foster Bird and other readers to warrant publication.

Camden, N. J. J. B. Rich.

Delays at Stations.

Editors:

In reading last month's paper the article on time lost at stations is just the thing, only not enough of it. I would like to say a few words if you can give my poor efforts space in "Locomotive Engineering." In stopping at local stations it is very seldom you see the agent out ready to wait on the train. He usually comes out of the office as if shot out of a gun after the train has been standing about two minutes. Then when he gets to the baggage car he has to hold a conversation with the baggage master, making the stop five minutes instead of two. If there is a large amount of baggage to load, the brakeman takes his time, as the longer time put in the less baggage he will have to handle. There is also considerable delay in stopping for train orders by the dispatcher not having orders ready.

In making six or seven stops with a ten-car train it is an easy matter to lose fifteen or twenty minutes, and it is always put on the motive power side of the house. If you make a good run it is done with the engine. You will get very little assistance from the train crew. The time put in at stations comes more to your notice when pulling two different crews on the same run. With one crew it is easy to make the time; when pulling the other it is almost impossible to stay on time. If engineers make it a point to stop at a certain point at each station, passengers will soon get on to it and be at that point to get on in place of being at the other end of the platform. If engineers make easy stops, passengers will be close to the door ready to get off, but after being stood on their heads two or three times they will stay in their seats till the train stops. A stop was made to answer a question. At a flag station a lady flagged a train. When the train stopped the conductor got off to help the lady on. She asked him if John Smith had sent a roll of carpet up for her. He said "Go ahead—" nothing else.

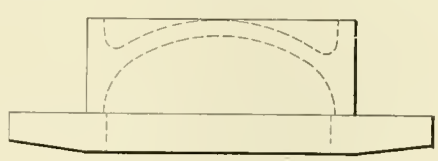
Wm. H. Holbrook.

Dennison, O.

Peculiar Wear of Valves.

Editors:

The sketch of the wear to the valve face, as shown in your paper for May, is misleading. I fear I could not have made the same clear. I shall therefore be glad



PECULIAR WEAR OF VALVE.

if you will kindly insert the accompanying sketch of a valve, and from which it will be seen that the face has three planes, and not two, as shown in your issue for May.

John Riekie,
N. W. Ry., India.

An Old Mason Ten-Wheeler.

Editors:

The communication of Mr. Foster Bird, entitled "A Curious Old Ten-wheeler," suggests an old photograph which I obtained from the Mason Locomotive and Machine Company. It illustrates a locomotive built by Mr. William Mason for the Lehigh Valley Railroad in 1870.

A comparison of the picture shown in your October issue with the one to which I refer, and of which I send a copy, indicates that they represent the same engine or "mates." The latter differs from the former principally in showing a diamond stack and four windows on the side of the cab. G. Franklin Starbuck.

Waltham, Mass.

[The photograph which our correspondent sends is practically the same as that shown on page 749 of last issue, except that it has a diamond stack, consequently, there is no use in reproducing it.—Ed.]

"Setting Valves by Sound."

Editors:

I would like to ask Mr. Fred E. Rogers, of the above article, in the October issue of the "Locomotive Engineering," page 749, why his engines with balanced valves invariably give a heavy exhaust at the back centers or just before the crosshead reaches the back end of the stroke? Why exhaust is heavier at that end than the other or passing the forward center?

He also says shorten the eccentric blades an amount that will depend on the conditions found, generally 1-16 inch. And if his engine would not act the reverse, if he were to back her up; then again, if his valve gear had worn equally on both sides, why should he invariably shorten the blades and not lengthen them?

I have practiced the idea of setting valves by ear for four or five years, and will admit that Mr. Rogers is plain enough in his article as far as he goes, but he does not give his reasons for making these alterations to true the sound of the exhaust.

My experience has been, and I have concluded that the cause of the heavy exhaust coming from the front end of the cylinders, was on account of the wear of the driving boxes and shoes, and when the wedges were set up it moved the eccentrics ahead that much, bringing the travel of the valve towards the pin (through the reversing motion of the rocker arm), consequently prolonging the opening of the front port, and proportionately decreasing the time of opening of the back port, thereby making the distribution of steam unequal in the two ends.

As Mr. Rogers says, shorten the blades the amount that will depend on the conditions found, he does not state whether to shorten all four blades or those of the forward motion only.

He also states that the sharp exhaust

from a locomotive fresh from the shop cannot be attained, and gives no reason why. And as to his idea of setting a slipped blade, I prefer to use the old rule of "setting the bad eccentric by the good one" first; then we are in a safe range to work by ear.

Suppose, Mr. Rogers, upon working steam with lever in corner, all exhausts were equal, and could not detect any difference up to the third and fourth notches (from the corner), but upon hooking up to the first or second notch from the center, she became lame, and if I understand you, you would shorten or lengthen the forward motion blade, as the case may be, until exhausts all sound equal. This would be conclusive evidence that the trouble is not in the forward blade (that is, by being square in corner and out near center), although the exhausts can be made to all sound alike by moving the forward blade (while hooked near center), but upon dropping the lever to the corner again she would be lame, where she was square before, the trouble lies in the back-up blade, and when the forward blade was moved to square her while hooked near the center, it threw the valve out as much in the forward motion as the back-up was in its direction, thereby dividing the deranged motions equally in each direction and by placing the reverse lever near the center (in either direction) the exhausts would sound equal, when in fact the valve motion is out in both directions.

I will leave this question open as it is and see how I fare at the hands of others before going further.

W. W. Pitts.

Hillsboro, Tex.

Old Lehigh Valley Mason Engines.

Editors:

In the September edition of the "Locomotive Engineering" I saw a picture of an old Lehigh Valley engine now out of service. The gentleman sending the picture also requested information concerning this engine.

This engine was one of a large number furnished the Lehigh Valley Company by William Mason. The engines were ten-wheeled, with the main rods connected to the front driving wheels. The driving-wheels were 50 inches in diameter. The cylinders and tongue part of the frame were built on an incline, to make the cylinder line in line with center of front wheel.

The cylinders were 17 x 24 inches; the boiler small in diameter but long and of the wagon top type. These engines, as the boilers wore out, were rebuilt on the old lines, with straight 54-inch boilers, and 18 x 24 cylinders. Lately extended smoke boxes have been added

These engines are great favorites among the employés. They have given the Lehigh Company more service and better service than any other engines on the road. These engines haul 175 to 190 coal "jimmies" from Packerton to Perth Amboy, and have started many trains that were stuck with the large moguls. They have an excellent shop record.

There are many of these engines still in service, few of them still having the original boilers. They form an interesting part of the history of the Lehigh Valley. Whenever you talk to a Valley employé about the motive power on the road you can always hear a good word for the Mason engines.

John Miller.

South Easton, Pa.

British Suburban Locomotive.

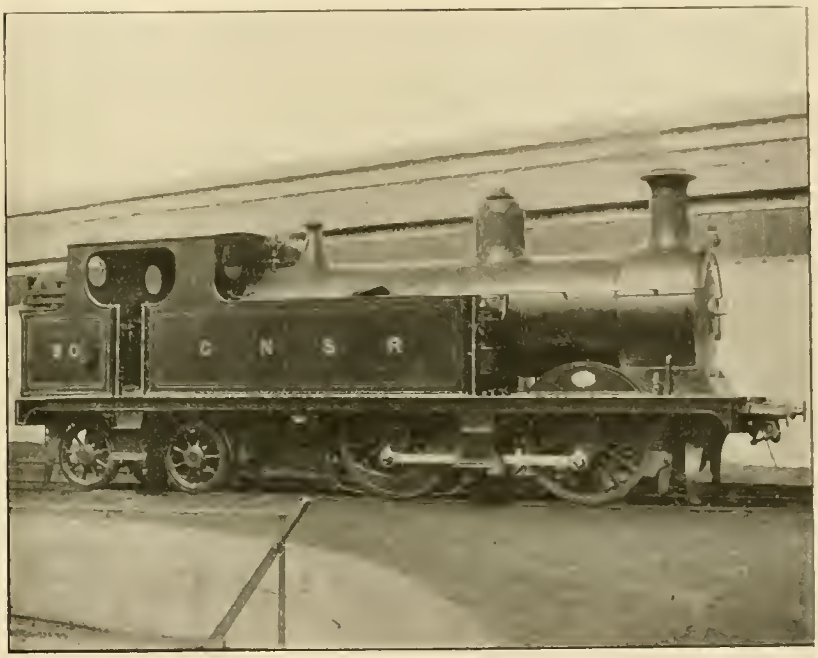
Editors:

Noticing in the August number of "Locomotive Engineering" that you devoted the chart of "Graphic History of the Locomotive" to American tank engines, I thought that it might interest your readers to see a typical British suburban traffic locomotive, and have accordingly sent you a photo of Great North of Scotland Railway engine No. 90, one of a class of the largest and handsomest tank engines running in Britain. Designed by Mr. Johnstone, the late locomotive superintendent, their dimensions are: Driving wheels (diameter), 5 feet; cylinders, 17½ x 26 inches; heating surface, 1,207 square feet; pressure, 165 pounds per square inch; capacity of tank, 1,200 gallons; water and engine weigh 53 tons 15 cwt. (2,240 pounds per ton). These engines handle the heavy suburban traffic on Deeside, and Aberdeen to Dyce, over heavy gradients.

Builders, Neilson & Co., Glasgow.

Trusting that photo reaches you in safety and that you consider it of sufficient interest to illustrate, remain,

Perth, Scotland. Sam. A. Forbes.



GREAT NORTH OF SCOTLAND SUBURBAN ENGINE.

A Disguised Blow at the Link.

Editors:

It has been remarked by different observers who have given attention to the outcome of the efforts of various individuals to supersede the link, that that rather common adjunct of a reversing engine is a real good thing for inventors to let alone when possessed of an idea of using something else in its place. Judging from what one sees, it seems to ordinary humanity that when an inventor starts out to supersede the link he does so fully impressed with the belief that the link has no business to distribute steam as it ought to be distributed, therefore it does not do so; this without any very mind-racking investigation of just what it really does do. A here's-what's-going-to-do-it conclusion seems to precede and conclude argument, which is perhaps as good a way to get along with the matter as any other.

Akin to those who periodically propose to throw the link into the scrap heap of obscurity, are those who are willing to retain it for the good it has not done, by making some sort of auxiliary attachment to the valve to correct the misdoings of the link; patch up its weak points. Sometime since allusion was made in "Locomotive Engineering" to a slip that was to go on the inside of the valve to slip around till it broke, and perhaps broke a cylinder, in the meantime accomplishing something that there was no pressing need of accomplishing.

With the slight objections to cost of maintenance, and the danger of breaking a cylinder once in a while, the inside slip was both harmless and useless, the gist of which was a good deal in its favor, as such things go, and the latter not very much against it.

The latest device to circumvent the action of the link is about as nearly opposed to the inside slip, which ingeniously enough interfered with the inside lap, as may be. It boldly, when given a fair chance, attacks the outside lap. It is an outside slip.

To arrive at an understanding of what this slip is like, imagine a thin rectangular piece resting on the valve seat. Through this piece is a rectangular slot, in which the valve fits easily in one direction, while in the other direction—the direction in which the valve travels—the slot is as wide as the face of the valve plus the width of one of the steam ports; and here is where the slip feature comes in. This rectangular affair, together with some shoes to prevent the slip—that's my name for it—leaving the seat, some nuts, washers, springs, etc., are all that are likely to get rattling around loose in the steam chest and cylinder unless the slip breaks some day, which is rather likely to be the case.

This is merely mentioned in order that it may be seen that there might have been more pieces likely to get wandering around promiscuously. The valve is nearly, or quite, without lap, and the operation is supposed to be as follows: When it begins to move in either direction the slip remains stationary if it behaves itself, until the port is fully open, then the valve strikes the slip a smart blow and carries it —or its pieces—along with it. If the valve overtravels the port the slip covers the latter to the extent of that overtravel. When the valve moves back so far that the edge of its face strikes the inside face of the rectangular slot in the slip, cut-off would occur, were it not for the fact that the pounding the surfaces that come in contact—the exterior edge of the valve and the interior edge of the slip—get, speedily puts them in condition to form what could be described as almost anything but a tight abutment. Partial suppression would be better than cut-off.

As if to discount the action of the link as far as possible, thereby, of course, gaining important advantages, the greater the travel of the valve, as will be apparent, the shorter the cut-off, so called.

Notwithst_nding th s latest rather severe blow at the link, this ignoring of it, as it were, misguided people will, just as likely as not, continue to use it, valve and all, to let steam into and out of the cylinders of steam engines pretty much as it does now. And there will be those who will persistently continue even to commend it for the few traps it has about both valve and operating mechanism. This while the inventive progressionist deplores the fact that the intellectual density of the common sort of fellows who handle levers and control the doing of repairs object to sitting down on things that are old, just because they are good.

F. F. HEMENWAY.

Brooklyn, N. Y.

Threading Tool for Car Work.

Editors:

To cut the threads on pocket staples or U-bolts, rope staples and such work on an ordinary bolt machine requires the staples to be bent like *A* in the view of one-half of the staple; then after the threads are cut on the ends they have to be heated and put in straight position again like *B*, shown in the same view, and it has been found that the threads get more or less injured by that operation. To avoid bending, a special thread-cutting tool has been made, which can be applied to any bolt machine and which we will describe and illustrate by Fig. 1 and Fig. 2. *C* is a round iron bar and is threaded at *D*. *E* is a taper shank fitted to the hole in the spindle of bolt machine. *F* is drilled, and also hole *H H*, through which chips fall out.

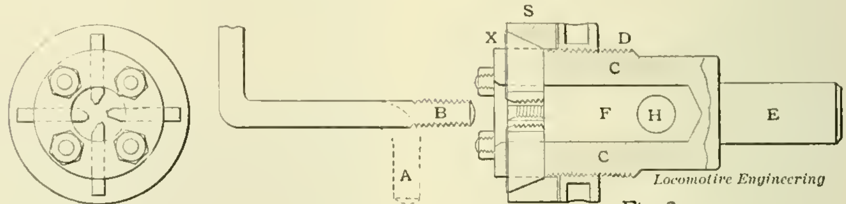


Fig. 1 Fig. 2

THREADING TOOL.

Four recesses are slotted to receive the dies so they will project 1-32" from face of bar. They will then act like a solid die when nuts are screwed up against collar *X*. To close the dies threaded ring *P* is turned forward, and this will also move sliding ring *S* forward on inclined ends of the dies and in that way closing them to the required size of bolt.

The dies in this case will not relieve automatically, the machine is reversed to its quick back motion and thereby bolt is backed out. One set of ⅝-¾-⅞ dies will answer very well for this kind of work.

J. A. EISENAKER,

Elmira, N. Y.

Nathan's Lubricators and Injectors.

A busy place is the Nathan Manufacturing Company's shops at this time, not only busy in preparation for the trade that is now more than prospective, but on the orders already at hand. Injectors that inject and lubricators that lubricate are put up on the interchangeable principle followed by the manufacturer that is not in business for purely hygienic reasons. In addition to so-called special tools, particular attention is given to designing labor-saving devices for ordinary tools, thus increasing their efficiency many fold; designs of this character are constantly under way, involving the best thought of experts in this line of work.

One of the neatest adaptations of a tool to the requirements of injector work is that of a large Bement & Miles horizontal borer to the boring, reaming and tapping processes demanded on these instruments. A quick hand return movement was applied to the machine, which increased its capacity greatly, in using the sectional adjustable taps and gang reamers by which the interior of an injector is brought to size and shape.

All lubricators sent out are now fitted with the Nathan patent circulation valve attachment, which was devised to insure action of the lubricator against the blocking of oil in the delivery pipes, due to the present high boiler pressures. This device has a hand oiler attachment, and is connected directly to the lubricator on one side, and to the delivery pipe on the other. The construction of the device is simple, consisting of a small valve opening near the receiving side of the choke plug, and held to place by a coiled spring. The valve is moved from its seat by means of the cylinder pressure acting on a diaphragm, and when the valve is unseated, the cylinder pressure joins with that from the lubricator and forces the oil through choke plugs to the cylinders.

The valve is simply an auxiliary to the lubricator, to overcome excessive back pressure in the delivery pipes, the lubricator feeding in the usual way until the pressure in the delivery pipes overcomes that from the lubricator, when it becomes operative at once. The testing plant is very complete in all details for the work, particularly that for testing injectors, in which a Babcock & Wilcox boiler is kept under 300 pounds pressure for use at a moment's notice. The plant, as a whole, is first class, as would be expected of one so long in the business.

The Carnegie mills have recently added Eberhardt's automatic gear cutters, 74 x 14 inches, for their large work, also 30-inch for spur, bevel and worm gears for their smaller work. These machines are marvels of automatic mechanism, and possess improvements never before put upon the market. They were supplied with cutters specially adapted for automatic machines.

Tender Draft Gear—Chesapeake & Ohio Railway.

A solid and permanent job, mechanically considered, is that of the draft gear applied to his tenders by Superintendent of Motive Power Morris, as shown in our engraving, in which is seen the Butler draw-bar attachments applied to the tender frame, in combination with a vertical plane coupler.

The channel center sills furnish a good opening for a substantial foundation on which to build, and it has been taken advantage of by introducing a cast iron frame to carry the draft rigging, the frame filling the space between the center sills for a distance of 34 inches and abutting against the end sill. At the rear end the casting extends down so as to form a pocket for the spring case and brings center of draw-bar to correct distance from the top of rail.

This affords a simple method and an inexpensive one of putting the Butler device on tenders with a metal frame, but it is not necessarily confined to that type of frame, as the casting idea may be worked up to suit any combination of conditions. The case presented is one that gives promise of a better status of things in tender draft gear than has been general practice in that detail.

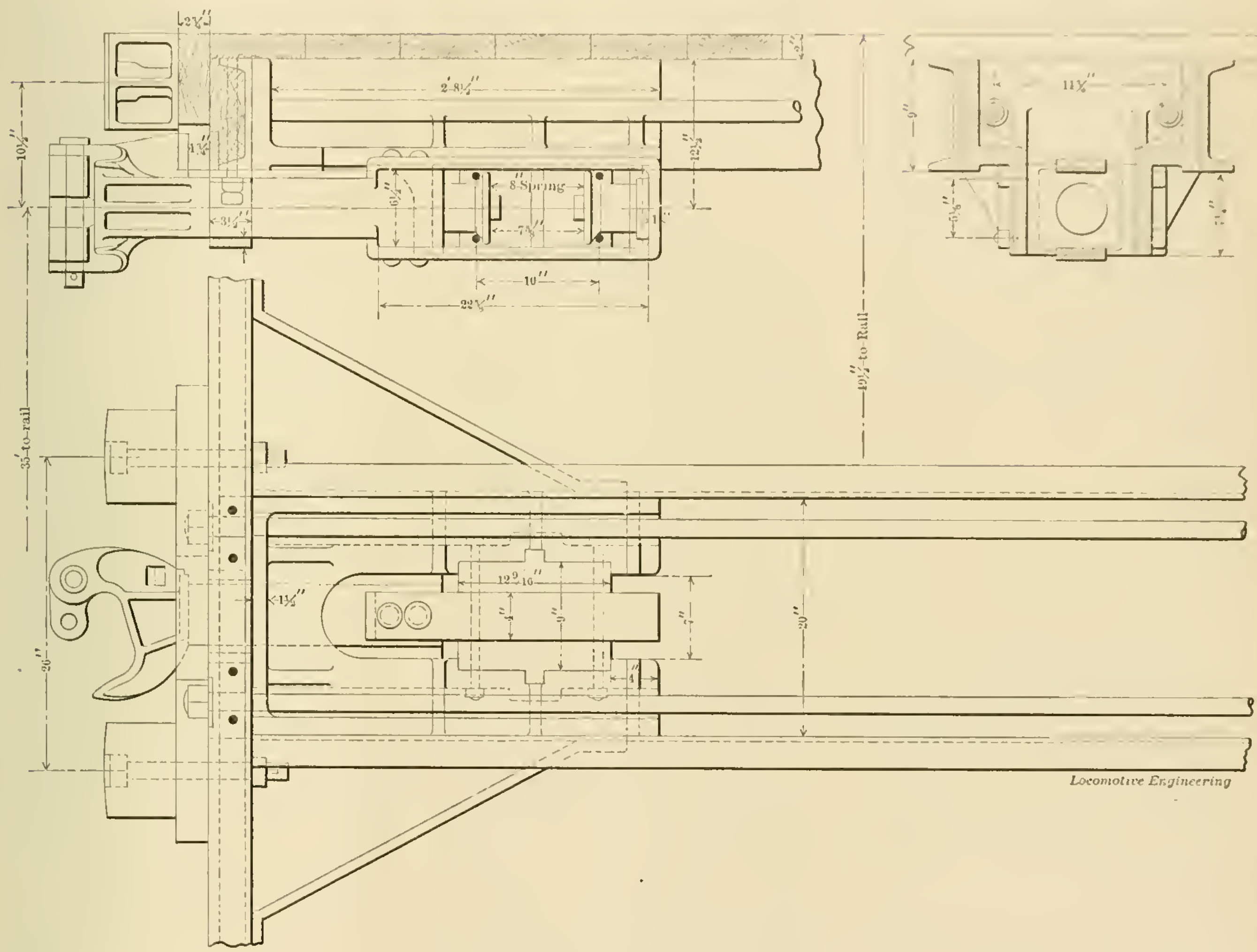
Locomotive Foremen's Club.

The Locomotive Foremen's Club has been established in Chicago for the purpose of discussing questions of important interest to enginehouse foremen. The first meeting was held at the rooms of the Correspondence School of Locomotive Engineers & Firemen, 335 Dearborn Street, Chicago.

The first officers of the club elected are: President, F. E. Pyle, Atchison, Topeka & Santa Fe; first vice-president, C. J. Quinby, Wisconsin Central; second vice-president, J. M. Thompson, Chicago & Northwestern; third vice-president, A. J. Cunningham, Chi ago & Western Indiana; secretary and treasurer, A. C. Beckwith, Illinois Central.

The club seems to have started out with great vigor to hold weekly meetings. At the second meeting, a paper on "Sight Feed Lubricators" was read by Mr. E. A. Bischoff, of the Nathan Manufacturing Co. The following week, a paper was read by Mr. W. J. Eddington, on "Testing Stay Bolts," and one by Mr. F. W. Furry on "Inje tors." The subjects so far have been of a highly practical character, and of the kind that will be likely to bring valuable inforn ation to the members of the club.

The conductor's air-brake valve on the equipment of the Long Island Railroad is now being operated by a cord which is carried by the same hanger used for the air-signal cord, the hanger having a double guide, with the signal cord in the usual place and the brake cord about three inches above. Mr. Prince, the superintendent of motive power, believes this arrangement has some advantages worth consideration, the most important of which is the accessibility of the conductor's valve from any part of the car. Emergencies like a broken car axle, for instance, require prompt action from the rear end, and a very good way to insure a quick stop from that end is to make it possible to reach the conductor's valve in the shortest space of time.



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May Help Steam Railways to Win Back Suburban Business.

Yesterday, while the writer was enjoying a quiet wheel ride amongst the sylvan scenes of New Jersey, his reveries were interrupted by the remarkably lame exhaust from a laboriously working locomotive, and on looking up he beheld a large mogul engine pulling three passenger cars that were nearly empty. Electric trolley cars had been seen several times during the day skimming along lightly, carrying as many passengers as were in the steam car train. We estimated that the engine and tender of the train weighed 210,000 pounds, and that the cars weighed 150,000 pounds.

This naturally started a train of thought about the relative cost of moving passengers under the two systems, and new light seemed to shine on the cause of electric cars knocking steam trains out of suburban service. Then the reflection came, why do not steam railroad companies try steam motors driving light cars? It seemed possible to use the weight of the car for adhesion just as the electric companies do and employ a light high speed steam engine connecting directly with the car truck. This proved to be a fertile subject for thought, and it clung so tenaciously that we spent some time in the evening sketching and figuring on a steam car motor, and had resolved to push the device upon the notice of some of the railroad managers who are rapidly losing the most valuable part of their suburban traffic. In our mail next morning were description and photographs of the composite car and motor recently built by the Schenectady Locomotive Works for the New England Railroad, which appear in another part of this paper. The "composite" came so near swallowing the ideas we had been embracing the previous evening that we determined to permit the railroad companies and locomotive builders to work out the armor needed to wrestle with the electric people.

One cannot examine the details of this "Composite" without marveling why something of the kind had not been tried earlier. While the street car companies were everywhere pushing out into steam railway territory and striving with giant power to perfect their motors and develop their cars, the steam railway companies have kept on in the even tenor of their way hugging antiquated practices and clinging to the ancient, heavy, expensive machinery, without the least effort to work out improvements that would put them in line with modern methods.

The increase in the weight of locomotives and cars, while wise policy, as a rule, has not always been carried on judiciously. A heavy locomotive with considerable margin of power can move a heavy train more economically than one which has to be pushed near the limit of its capacity to do the required work. On this account, it has become fashionable to act as if the motive power could never be too great for the load. When street railway companies began to parallel suburban steam railroads, and when they proceeded to put in practice their policy of taking possession of the principal statute roads extending into every district where paying passenger business could be worked up, they acted with extraordinary sagacity in promoting their own interests. The leaders in this movement perceived that frequent service and attractive cars would develop travel and draw passengers away from the steam railroads. They gave that kind of service, and it proved successful. The cars were made as light as possible consistent with safety, and every care was taken to do the work of car moving with the least possible expenditure of power. Men with the intelligence and judgment displayed by the electric street railway managers could not be easily worsted even had steam railroad managers understood their own company's interests and defended their business with shrewdness equal to that of their new competitors. Instead, however, of meeting novel motive power appliances with aggressive changes and improvements in the same line, most of them ordered heavier engines and cars and widened the time between trains. They succeeded in saving a few pounds of coal per car-mile, and their wages account was lower for the thousand passengers carried, but their volume of passengers was smaller than it would have been under more sensible management, and they lost money by the change.

The few that tried light trains considered any kind of scrap engine good enough to haul them. The delays constantly resulting invited failure.

The New York, New Haven & Hartford management has been almost unique in fighting the street railroad companies with their own weapons. They are running electric cars in opposition to street cars on two parts of the system in New England, and this steam motor car has been built for the New England part of the New Haven company. Its use will demonstrate how far direct steam driven cars can compete with electric cars driven from power stations. With hour intervals between cars, there is no question that the independent motor will do the work at least expense. When cars are run every half-hour, over a circuit sixteen miles long, the motor is almost certain to come out ahead; but as the intervals of time between cars are reduced towards the shortest practical limit, a point will likely be reached where the electric cars have the advantage. This steam motor car introduces a factor into suburban train operating which can be employed to ascertain with certainty the relative economy of steam motors and electric motors. There has hitherto been no fairly accurate means of making this comparison.

Steam railroad companies having suburban passenger business, ought to be deeply interested in the performance of the steam motor car; firstly, because it indicates the way to compete with rivals, and secondly, because it will eventually prove whether or not it is well to change to electric operating, and when the time for making such a change is due.

The motor used to drive this car is wonderfully powerful, and gives the means of hauling another car with ease where the grades are not heavy. The "composite" will enable railroad companies to provide a frequent car service at moderate expense, and will thereby put them in a position to win back some of the business the street railroads have been taking away from them.

Small Steam Ports Give Better Results Than Large Ones.

We have several times given reasons for the belief that our locomotive designers are falling into an expensive delusion in their efforts to follow the makers of automatic steam engines in designing the proportions of steam ports. Unfortunately, we were not able formerly to cite the results of experiments to support our views on this question, but we have given notes on the relative coal consumption of engines having comparatively small ports with that of others having very large ports. The facts collected seemed to bear satisfactory testimony that the short-ported locomotive gets all the steam into the cylinders that can be used, and uses a smaller volume to do the same amount of work.

We are now gratified to say that experiments made by Mr. Robert Quayle, superintendent of motive power of the Chicago & Northwestern, on his experimental plant, and experience on the road, have demonstrated that engines with ports 16 inches long did the work better than the same engines with the ports 20 inches long. The ports were reduced only at the seat, leaving the piston clearance practically the same, so that it is reasonable to suppose that an engine having the clearance reduced in the same proportion as the port, would produce much better results in the way of steam economy.

The experiments were made with large eight-wheel passenger engines having steam ports 20 inches long. They all have false seats, so there was no difficulty in substituting ports 16 inches long, and valves to fit them. To the surprise of the investigators, it was found that the small valve gave a little better mean effective pressure than the large one, which would probably be due to the reduced spring of the valve gear. Several of the engines with the ports reduced to 16 inches are now running the heavy express passenger trains between Chicago and Clinton, which frequently consist of twelve cars, and they are doing better work than they did when the ports were 20 inches long.

This ought to be evidence sufficient to make the lovers of large steam ports pause and wait further developments. The probable saving in coal that would result ought to induce some enterprising railroad company to invest in a new pair of cylinders with reduced steam ports to run against an engine of the same class having long ports. Many expensive experiments have been made on investigations of much smaller importance.

The practice of making the steam ports very large is bowing the knee to theories which are all right when applied to certain engines, but probably all wrong for locomotives. This is not by any means the first time that locomotive designers have been allured into very expensive practices by adhering blindly to the gospel of the automatic engine designer.

It is a highly seasonable time at present to point out to locomotive designers the dangers besetting the road they are traveling, because at the last Railway Master Mechanics' Convention a report was adopted which commits those following the recommendations of committees to an increase in the proportions of steam ports beyond anything yet known in locomotive practice. The report in question recommended that the ratio of steam-port length in inches to cylinder area in square inches, for passenger locomotives, should be preferably about 10 per cent. This would require the ports of the Chicago & Northwestern engines to be 28.3 inches long, which is palpably absurd. The good sense of locomotive men prevents them from being carried away into excesses of this character, but they are liable to be influenced to some extent by the recommendations of men who have, presumably, given the subject careful consideration and exhaustive investigation. We have no doubt but the compilers of the report referred to were conscientious and painstaking in the work they did; but they worked on a false basis; they concluded that they must be safe in recommending for locomotives the proportions of ordinary steam engine practice.

The Application of Safety Appliances to Locomotives and Cars.

In March, 1893, an act was passed by the United States Congress, which was called: "An act to promote the safety of employés upon railroads by compelling common carriers engaged in interstate commerce to equip their cars with automatic couplers and continuous brakes, and their locomotives with driving-wheel brakes, and for other purposes." The act was a very short one, being only about 800 words long, but it was one of the most important edicts ever put upon the nation's statute-roll. It required that on or before July 1st, 1894, all cars used in interstate commerce should be built with uniform hight of draw bars. Another provision called for secure grab irons or hand-holds to be placed at the sides and end of cars by July 1st, 1895. It required that by January 1st, 1898, all locomotives moving interstate traffic should be equipped with power driving wheel brake and appliances for operating the train brake system, and that a sufficient number of cars equipped with power brakes should be in every train to enable the engineer on the locomotive to control the train without the aid of brakemen. On the same date, all cars employed in interstate traffic are required to be equipped with automatic car couplers. Severe pains and penalties are provided for those who fail to comply with this law.

When the law was passed, a great many railroad companies did not seem to take the matter seriously, for they paid no attention to it whatever, and appeared to think that it would be repealed before the time for enforcement came round. Others, under wiser management, proceeded to prepare for the day when the law would come in force. The first effect of delaying the changes called for was seen as the time for having the couplers of uniform hight was drawing near. Some railroad companies appeared not to realize that such a law had passed until within a month or two of its taking effect, when they had to proceed to work night and day to get their car equipment in shape to meet the legal requirements. The same state of affairs was revealed when the time for applying grab irons drew near. On some roads the greater part of the work had to be done by working day and night during the last month of grace.

On the first of next year, automatic brakes and car couplers must come into general use. Some railroad companies will be in a position to comply with the law by the day it takes effect, but others will be at the mercy of the Interstate Commerce Commission. Some time ago, under the lead of President Smith, of the Louisville & Nashville, a number of roads started a movement to put pressure upon Congress to delay the enforcement of the law in regard to the enforced use of automatic brakes and couplers. They hoped to obtain a general permission that would apply to all railroad companies, but it turned out that the railroads which had been equipping their cars and locomotives with brakes did not favor putting off the day of the change, and so the question was referred to the Interstate Commerce Commission. That board has power to delay the day of making the law compulsory; but the members will only grant permission on investigation of individual cases. If a railroad company has been so situated that it was practically impossible for it to comply with the law, it is likely to be granted longer time; but railroad companies which have been paying regular dividends are likely to find themselves in a bad position on the first day of next year. Some of the roads that are not in a position to comply with the law have been paying good dividends during the depression of business, and little mercy is likely to be shown to them. We expect there will be a rush to get on brakes and automatic couplers towards the end of the year, similar to what took place when the time for the application of grab irons was due.

Tonnage Rating for Locomotives.

Circulars have been received by this time, by the members of the American Railway Master Mechanics' Association, inviting their assistance in the solution of one of the most important questions ever embodied in a report to that body, namely, Tonnage Rating for Locomotives. This is a matter that has been slowly coming to the front for the past four or five years, and has received some attention in a few instances, in which it was demonstrated that motive power fell short of its mission as a paying factor in the transportation of freight, unless loaded to a point only limited by its ability to make schedule time.

Those that have given the subject attention have accumulated a fund of information of the highest character of usefulness, though perhaps applicable to individual cases only, and obtained under conditions rare enough to not be called general, yet such data will be just as welcome to the committee having this thing in hand, as the most elaborate compilation of results covering a long continued series of experiments or calculations.

It is hoped the committee will have the encouragement it has a right to expect, and receive early and complete answers to all the questions bearing on the subject of tonnage rating, sent out by the chairman, G. R. Henderson. Common courtesy ought to insure the co-operation asked for, but professional courtesy and a pride in the reputation of the Association's work should outweigh all other considerations and bring out such a flood of suggestions as will enable the chairman of the committee to fully equal the record established by his previous good work in the Association.

Want of Punctuality.

Punctuality is a virtue that is thoroughly appreciated in all lines of business, but it is peculiarly so among railroad men, especially in those connected with train service. A man who permits himself to fall into habits of arriving late makes himself a nuisance; and however capable he may be in doing his work, the habit of appearing late will exert a strong influence against his advancement.

There are some men who never can get to their work in time, no matter what hour they may be called. We have known shopmen who were habitually late, and when short hours were inaugurated they were just as tardy in getting around at 8 as they were at 7 o'clock. A shop man is the worst sufferer himself from this habit, but in the case of a trainman his weakness is a source of constant annoyance to the officer responsible for getting engine or train out on time.

An engineer who is habitually late does injustice to himself, to his engine and to the company employing him. We all know of men who seldom reach their engine until it is time to back on to the train, and they are still dropping oil upon the most important bearings when the signal is given to start. It is no wonder that this kind of man meets with no end of trouble from hot bearings and from breakages due to want of proper inspection. The fireman who arrives close on starting time is a burden to the engineer, and begins the run with irritation that generally lasts the whole trip and with a fire that insures the losing of time for the first ten miles.

A peculiarity about this want of punctuality is that it is not always the lazy man who is most afflicted with the habit. It seems to be due mostly to careless want of foresight. The habit does not deserve to be treated lightly, for that treatment generally cultivates the malady. The foreman of a large engine house, talking on this subject, said: "When I took charge I found that the rule concerning the time the engineers should reach their engines was practically a dead letter, and I was constantly harassed to get the engines out on time. After getting reproved twice for engines delaying trains, I told the men that they must come round on time or lose the trip. During the first week several engineers and firemen found others in their places when they reached their engines. That stopped the annoyance, and the men as a whole are highly satisfied with the change."

There have been kings nicknamed the Unready, but they were of little use in the world. The most celebrated unpunctual man was Charles Lamb, the noted wit and writer. He was employed in a government office, and in the old days before civil service rules were dreamed of it took long and persistent delinquency to incur displeasure from unpunctual habits. But Charles was so regularly late that his chief was moved to remonstrate. "You are never at your desk on time, Mr. Lamb," said the chief. "I don't know what to do with you, for your want of punctuality is having a bad effect upon the whole office." "I am so-so-sorry," replied Lamb, who was a great stammerer, "but there is one thing you must give me credit for—I am always punctual in go-go-going away at night."

There are a good many people who are like Lamb—punctual only at quitting time.

Lies About Railroad Men Being Wanted in China.

We have received a copy of the Worcester "Daily Telegram," containing particulars of an interview with one George W. Horton, recently returned from China. In the course of this interview, Mr. Horton says: "Railroad lines will be established as fast as possible all over China. American railroad men will be in great demand there, and are now, and I think the men that know that business thoroughly and go there first will earn more money than they ever did before. Engineers will be paid at least $250 a month, and firemen will get nearly as much. Li Hung Chang thinks there are no better railroad men than Americans, and he will hire all he can get. He sent a representative to America sometime ago, and I understand he has engaged a number of engineers and firemen, but many more will be needed."

We know that the publication of this statement will bring us a great many letters from engineers and firemen asking for the address of the parties who are engaging railroad men to go to China. We have gone all over this several times before, and we want to say that we do not believe there is a word of truth in what it is reported Mr. Horton says. On account of a similar story published in a New England paper months ago, we were flooded with letters, and made inquiries at the Chinese Consulate and received information that there was not a word of truth in the report.

We have made similar inquiries again among the Chinese officials and can assure our readers that there is no demand in China at present for railroad men.

Difficulties in the Way of Keeping Time.

At a recent meeting of railroad officials one speaker remarked: "Our trains are controlled by train dispatchers and a single track, and I should like to know how much time is lost waiting for orders." Another, taking up the question, said: "I had occasion to look up a matter of that kind through a complaint that the engine on certain runs was not making time, and I had the train checked several days in succession, and found that there was about fifty minutes lost at stations."

There has been for the last few years an inclination displayed by competing lines to offer high train speed as an inducement for the patronage of travelers. This has been pushed to such excess that the railroads are physically unable to make the time advertised, while the locomotives are pulling a paying load. Yet the parties soliciting business insist that the schedule of fast speed shall be retained, and they figure very conclusively in the seclusion of their inner office that no difficulty ought to be experienced in making the speed offered to passengers. Then the responsibility of taking the trains through on time is thrown upon the operating department. On some railroads the details of train running are so closely observed and recorded that the failure to make the required time is immediately identified and those at fault are called upon for explanations, but on the majority of roads the records are so imperfectly kept that a failure to make the running time is at once put upon the locomotive and thence the blame is transferred to the head of the mechanical department. We have known of several heads of the mechanical department of railroads who fell into disrepute with the management because important trains were habitually late, and the hard feelings aroused resulted in the despicable notice, "Your resignation will be willingly accepted."

An immense amount of injustice has been done in this way. In the first place, the tendency is to expect too much from the motive power, and there is not sufficient discrimination concerning conditions that prevent the locomotives of one road from performing the work done by the engines on another road. A railroad manager in Illinois finds out the weight of trains pulled by locomotives on a leading Eastern railroad and notes the speed between terminals. Then he calls upon the head of his mechanical department to do likewise and brooks no excuse for failure to give as good a performance. The conditions of superior coal, engines kept in first-class condition and a systematic watch to prevent delays on the road and at stations are ignored. These conditions materially favor the Eastern road, especially the stringent care exercised to give the engineer a free line between stopping points and the vigilance in making agents, expressmen and baggagemen do their work so expeditiously that no unnecessary time is lost at stations.

Every railroad ought to be provided with automatic speed recorders, and these ought to be applied to every train that fails to make the running time regularly. We hear a great deal about particularly high speed made by trains under favorable circumstances, but we believe that the most reckless train running performed on railroads is done where unnecessary delays at stations urge the engineer to do everything in his power to reach the terminal station on time. Chances are taken under these circumstances with inferior track and crowded stations that often result in disaster, although the real causes of the accidents are not identified. The small outlay needed to maintain automatic speed recorders on the engines of fast trains would be a good investment.

BOOK NOTICES.

"Railway Engineering, Mechanical and Electrical." By J. W. Holdare, M. E. Published by Spon & Chamberlain, 12 Cortlandt street, New York. Price $6.

This book of 560 pages is decidedly diverse in character and deals with about everything that refers to railroading in any way, such as surveying, tree felling and sawing, and other similar branches, from an English standpoint. The Atlas Works locomotive department is thoroughly described and illustrated, and their methods of building will probably interest builders on this side of the water.

Traction engines and electrical transportation is also shown while one chapter is devoted to rolling stock, a portion of this being devoted to American practice. It deals almost entirely with the construction instead of the operating department.

"American and Other Machinery Abroad," by Fred J. Miller, editor "American Machinist." Published by the "American Machinist," New York. Price 50 cents.

The letters on the above subject which Mr. Miller contributed to the "American Machinist" during his trip abroad, are, without exception, the most interesting and most valuable which have ever appeared on this subject. They have been reproduced by foreign technical papers and spoken of in the highest terms by them, even though the letters occasionally criticized their methods rather severely.

They are an accurate record of the conditions existing to-day, which have to be met by American manufacturers in sending tools abroad. Besides this, they are very interesting to the mechanic who wishes to be thoroughly up to date.

"Standard Electrical Dictionary," by T. O'Conor Sloan, A. M. Published by Norman W. Henley & Co., New York. Price $3.

This is a revision and enlargement of the first edition, which met with a ready sale and well merited approval. The title is a trifle misleading, because it is not merely a dictionary, but a condensed encyclopedia or book of reference, with the terms and subjects well arranged for finding any desired information. It is fully illustrated, well printed and bound, has 682 pages, 3¼ by 7 inches, and can be highly recommended to those who wish to become familiar with electrical terms and apparatus. It is an authority on the subject, as Professor Sloan is a well-known author.

"Slide Valves," by C. W. MacCord, Jr., M. E. Published by John Wiley & Sons, New York. Price $2.

The subject of slide valves is always interesting to engineers and mechanics generally, and the author makes clear many points which often puzzle a student. The subject of valve design is made as plain as possible with the Zeuner diagram, but we consider the Bilgram, the Sweet, or the diagram given in Part VII of Professor Meyer's "Easy Lessons in Mechanical Drawing and Machine Design" much more easily understood than the Zeuner diagram. The book covers about the same ground as the one by Mr. Halsey on the same subject, with the exception that Mr. MacCord adds a chapter on the Principles of Shaft Governors. There are 168 pages, 5¾ by 9 inches, and 101 illustrations.

Our book department has just completed a careful revision of the book list which will be found among our advertising pages. The books mentioned in that list are the best of their kind, and are those most in demand by railroad men and mechanics. We handle a great many more books than we can find room to mention. In fact, we are prepared to take subscription for any book, journal or magazine published. When we began the publication of "Locomotive Engineering" we announced that we would have nothing to do with the sale of books, and made several sacrifices on that idea; but our readers were so persistent in ordering books and papers through this office that we were forced into the business, and now we are doing our best to make the book department a success.

The Holman Again.

The Holman engine has again astonished the world, according to the newspapers, by making a mile in 30 seconds—120 miles per hour. A Philadelphia correspondent, who is acquainted with the facts of the case, writes: "The best mile that the Holman speeding truck made in going to Cape May was a mile in 48 seconds. The miles in 30 seconds were made on the return trip when no one was timing it. It has always been easier to make fast time under these conditions than when the miles are measured and a watch used to tell the time, instead of guessing at it." There is quite a little sermon in these few words.

We have received the "Universal Directory of Railway Officials" for 1897. This work is compiled by S. Richardson Blundstone, editor of the "Railway Engineer" of London, who is to be complimented on the completeness of the work. The book gives a list of all the railways of the world, together with the principal officials of the same, and is almost indispensable to those connected with or desiring intercourse with railways. Published by the Directory Publishing Company, Ltd., London, England. Price 10 shillings.

There is some reason for believing that acetylene gas will be extensively used as a power producer for industrial purposes. Several street omnibuses in Paris are run by acetylene gas, and they work very satisfactorily. A strong recommendation of acetylene gas for moving vehicles is that the material and apparatus to be carried are very light. The generators used in the Paris vehicles are only about one-tenth the weight of electric accumulators required to produce the same amount of power.

"American Trade" is the name of a new monthly journal started by the National Association of Manufacturers of the United States, for the purpose of pushing foreign trade. We have received the first number, which came out in October, and from a careful examination of its four pages, we are inclined to think that it would be a very useful publication for those who are looking for foreign trade.

We have received a copy of the "Railway Magazine," published at Temple Chambers, Temple avenue, London, which is a new candidate for popular favor. It is an elaborately illustrated magazine, and contains a variety of very interesting articles. It is sold for the modest price of sixpence a month, which is a little less than $1.50 a year.

PERSONAL.

Mr. John M. Egan, vice-president of the Central Railroad of Georgia, has been elected president of that road.

Mr. E. M. Humestone, master mechanic and assistant superintendent of the Philadelphia, Reading & New England, has resigned on account of ill health.

Mr. A. Dallas, general foreman of the Chicago, Rock Island & Pacific, at Herington, Kan., has been transferred to Goodland, Kan., to succeed Mr. A. McCormick, resigned.

Mr. W. C. Buly, foreman of the Wabash shops at Delray, Mich., has been appointed master mechanic at Decatur, Ill. Mr. Herman K. Mudd succeeds him as foreman at Delray, Mich.

Mr. Clarke Haire, assistant superintendent of the Saginaw & Mackinac divisions of the Michigan Central at Bay City, Mich., has been transferred to the Toledo division at Toledo, O.

At a recent meeting of the board of directors of the Pittsburg & Lake Erie, Mr. S. R. Callaway, president of the Lake Shore & Michigan Southern, was chosen president of that road.

Mr. E. Ford, general superintendent of the Buffalo, St. Mary's & Southwestern, has resigned, and Mr. B. E. Wellendorf has been appointed to the position. Headquarters at St. Mary's, Pa.

Any railroad company needing a good, clear-headed, first-class mechanic for master mechanic or general foreman can be put in communication with such a man by dropping a line to the editor of this paper.

Mr. J. J. McGrath has been appointed general foreman of the Monterey & Mexican Gulf Railway at Monterey, vice Mr. Henry Kistner, resigned, to accept position on the Missouri, Kansas & Texas Railway.

Mr. F. E. House, chief engineer of the Pittsburg, Bessemer & Lake Erie, has been promoted to be general superindent of that road, and the office of chief engineer has been abolishd. Headquarters at Pittsburg, Pa.

Mr. T. M. Feeley, master mechanic of the Anniston division of the Southern Railway at Selma, Ala., has been transferred to the Birmingham division, succeeding Mr. W. A. Stone, resigned. Headquarters at Birmingham, Ala.

Mr. Albert S. Ingalls has been appointed assistant superintendent of the Cleveland and Indianapolis divisions of the Cleveland, Cincinnati, Chicago & St. Louis, with headquarters at Cleveland, O. He is a son of President Ingalls of that road.

Mr. Chas. M. Hays, formerly general manager of the Wabash, now president of the Grand Trunk of Canada, has been elected president of the Chicago & Grand Trunk, and of every road in Michigan going to make up the Grand Trunk system.

Mr. Harry D. Galbraith, of Ossawatomie, Kan., has been appointed master mechanic of the Cotton Belt Railroad at Texarkana, succeeding Mr. W. C. Mitchell, who has been appointed general manager of the Lima Locomotive Works, Lima, O.

Mr. W. G. Purdy, second vice-president of the Chicago, Rock Island & Pacific, has been chosen to succeed the late Benjamin Brewster, as first vice-president, and Mr. W. H. Truesdale, third vice-president, has been chosen vice-president.

Mr. J. T. Robinson, foreman of locomotive repairs of the Southern Railway at Macon, Ga., has been promoted to the position of master mechanic of the Anniston division of that road, vice Mr. T. M. Feeley, transferred. Headquarters at Selma, Ala.

Mr. W. M. Hobbs, division superintendent of the Chicago, Rock Island & Pacific, at Horton, Kan., has been promoted to the position of superintendent of the Iowa division of that system, succeeding Mr. Harry Fox, resigned. Headquarters at Des Moines, Ia.

Mr. J. B. Gannon has been appointed master mechanic of the Southern Railway, vice Mr. V. B. Lang, resigned. Headquarters at Louisville, Ky. Mr. Gannon is an old-time friend of "Locomotive Engineering," having been a club-raiser at High Bridge, N. Y.

We had a pleasant call last month from Mr. E. J. Shrader, mechanical engineer for the West Australian Freight & Express Co., with headquarters at Perth, West Australia. Mr. Shrader left us some photographs of station scenes, which we hope to use in the near future.

Mr. L. E. Rhodes, formerly of The L. E. Rhodes Company, of Hartford, Conn., prior to that, for many years connected with the Pratt & Whitney Co., has associated himself with the Davis & Egan Machine Tool Co., of Cincinnati, O., and will have charge of the department manufacturing Lincoln millers, hand millers, etc.

Mr. C. H. Quereau, general foreman of the mechanical department of the Burlington & Missouri River Railroad, in Nebraska, at Plattsmouth, Neb., has been appointed master mechanic of the Denver & Rio Grande Railroad, with headquarters at the Burnham shops, Denver, Col. Mr. Quereau was formerly with the Chicago, Burlington & Quincy, and rose through the department of tests. He has contributed some remarkably good papers to the railroad clubs.

Mr. E. M. Roberts, the well known master mechanic, has been appointed assistant superintendent and master mechanic of the South Atlantic & Ohio Railroad, vice Mr. C. M. Lielich, assistant superintendent and Mr. John King, master mechanic, both having resigned their positions. We are glad to welcome Mr. Roberts back into railroad ranks again. His headquarters will be at Bristol, Tenn.

We regret to announce the death of William Barnes Bement, of Bement, Miles & Co., Philadelphia, Pa., in his eightieth year, due to the rupture of a blood vessel of the heart, caused by a severe coughing spell. He has been in mechanical harness since 1854 and had a varied experience, the present well-known works being started in 1851. The success of the firm needs no mention, its tools are known the world over.

The office of the superintendent of car department of the Lehigh Valley has been moved to South Bethlehem, Pa., and the title of Mr. John S. Lentz, superintendent of car department has been changed to assistant superintendent of motive power. He will have control of all car work and car shops, and will report to the superintendent of motive power. He will also communicate with each master mechanic in all matters relating to the mechanical execution of car work.

We understand that the South Kensington Museum, of London, which is in possession of a great many railroad antiquities, has applied to Mr. David Joy for the original drawings of various locomotives, which he designed many years ago, and that he has agreed to lend them to the museum. Mr. Joy, who is the inventor of the valve gear which bears his name, designed some of the most famous locomotives used in Great Britain—locomotives which leave their mark upon the present engine.

Mr. C. L. Mayne has been advanced from the position of assistant general superintendent to that of general superintendent of the Fitchburg Railroad, to succeed Mr. W. D. Ewing, resigned. For his years, Mr. Mayne is an old railroad man having entered train service in 1872 as train operator on the Lake Shore & Michigan Southern. He went to the Fitchburg Railroad in 1892 as division superintendent. His energy and ability quickly marked him for a higher position, and he was only a short time there when he was made assistant general superintendent.

The Baltimore "Sun" is authority for the statement that probably the oldest station agent in the country in point of service is James A. Gary, the Postmaster-General of the United States. He was appointed agent at Alberton, Howard County, Md., on the Baltimore & Ohio Railroad some forty-four years ago, and his name still appears on the payrolls of the company. The two next oldest Baltimore & Ohio agents are said to be Capt. Charles W. Harvey at Ellicott City, Md., and John W. Howser at Relay. They have each been in the service thirty-four years. The Baltimore & Ohio have also, in actual service, a passenger conductor, Capt. Harry Green, who has run trains between Baltimore and Cumberland for forty-seven years.

Mr. H. F. J. Porter, general sales agent of the Bethlehem Iron Company, with headquarters at 1433 Marquette Building, Chicago, Ill., has during the past six months been located at the works in South Bethlehem, Pa., during the absence in Europe of Mr. R. W. Davenport, second vice-president. Mr. Porter is spending a few days at his office in Chicago, and reports that there is a decided improvement in the steel forging business in the East, and that there are evidences that business will pick up rapidly in the West. He will return to the works and have his headquarters there during the winter. His Western office will be in charge of his assistant, Mr. Erwin Nelson, who will be glad to answer all correspondence and give information on matters relating to steel forgings of all descriptions.

The following appointments have been made on the Grand Trunk Railway: Thomas Hardy, road foreman of engines, districts 1, 2, and 3, headquarters, Richmond; Felix Payette, road foreman of engines, districts 4, 5, 6 and 7, headquarters, Montreal; Wm. Newcomb, road foreman of engines, districts 15, 20, 21, 22 and 23; headquarters, Stratford; Robt. Rutherford, road foreman of engines, districts 16, 17, 18, 19 and 24, headquarters, London. The position of foreman at Fort Erie is abolished. Mr. S. Warren will have charge of motive power matters at Niagara Falls, in addition to his car department work, vice Mr. W. F. Broughton, resigned; Mr. Bryce Stimson is appointed foreman at York, vice Mr. J. S. Broughton, resigned; Mr. W. Kennedy is appointed foreman at Point Edward, vice Mr. W. Todd, resigned. Mr. W. Aird is appointed master mechanic, instead of acting master mechanic, in charge of Montreal shops.

Mr. Lucius Tuttle, president of the Boston & Maine, is exceedingly popular with Boston people, and in fact with all the business men he has to deal with in New England. His recent re-election for the fourth year as president moved the "Boston Transcript" to publish a very laudatory article about him. The article concludes: "Not only in his office and elsewhere is it a pleasure to meet Mr. Tuttle, but at hearings where questions affecting the interests of his railroad are under consideration, he is a speaker whose clear, forcible, persuasive statements, and evident sincerity and straightforwardness appeal almost irresistibly to all who listen to him. The Boston & Maine Railroad and the people of Massachusetts and of New England are to be congratulated upon the continued presence of a man, at once so able and so broad and genial, as Mr. Tuttle at the head of its great vertebral railway system, which has become still more such since he took charge of it. The confidence which his four years' service has generated in the minds of the people make him of more value this time than he ever was."

Among those who accompanied Lieutenant Peary on his recent trip towards the North Pole was Mr. Charles A. Moore, Jr., son of Mr. Moore, the well-known member of Manning, Maxwell & Moore, New York. Young Mr. Moore made the trip with Lieutenant Peary not from an adventurous idea, but after he had thought it out very thoroughly, and expressed a desire to spend his vacation that way, rather than fooling around summer resorts, dancing and having what they call a good time. He had a wonderful experience. Only four ships have ever been further north than they went on this trip. He was with the party which was the first to visit the camp of the Greeley party since the rescuing party found Greeley and his men there. He secured a number of very fine and interesting relics of his trip, and brought home two fine walrus heads. One of them was the first one he shot, and the first shot he made at a walrus was successful in bringing him down, and they are quite good sized game, weighing from a ton to a ton and a half each. The scenery he describes is almost beyond the power of human words to convey any adequate idea of, and living a month in the Land of the Midnight Sun is, of course, interesting, particularly to a young man who feels interested in travel and fishing and gunning.

EQUIPMENT NOTES.

Murray, Dougall & Co. are building one car for the Empire Oil Works.

The Lenoir Car Co. are building 350 freight cars for the Southern Railway.

The St. Charles Car Co. are building 250 freight cars for the Wabash Railroad.

The Illinois Central Railroad are having two passenger cars built at Pullman's.

The Florida & East Coast Railway are having four passenger cars built at Pullman's.

The Kellogg & Spencer Co. are having four freight cars built by Murray, Dougall & Co.

The Georgia Railroad Co. are having ten freight cars built at the Mt. Vernon Car Works.

The Southern Railway Co. are having 500 freight cars constructed by the Ohio Falls Car Co.

The Munissing Railway Co. are having one passenger car built by the Barney & Smith Car Co.

The Illinois Car & Equipment Co. are building 200 freight cars for the Armour Car Lines.

The Pittsburg Locomotive Works are constructing six ten-wheel engines for the Iowa Central.

The Wabash Railroad have ordered 250 freight cars from the Missouri Car and Foundry Company.

The Southern Railway Co. have under construction by the Barney & Smith Co. six passenger cars.

The Mather Stock Car Co. are having ten freight cars built by the Indianapolis Car & Foundry Co.

The Southern Pacific Railway are having ten passenger cars built by Barney & Smith Car Company.

The Wells & French Car Co. are building 200 freight cars for the Continental Freight Express Co.

The Grand Trunk Railway system are having 500 freight cars built by the Michigan Peninsula Car Co.

The Chicago, Milwaukee & St. Paul are having eight passenger cars built by the Barney & Smith Co.

The Pittsburg & Lake Erie Railroad are having 50 freight cars built by the Schoen Pressed Steel Co.

The Michigan Peninsular Car Co. are building 200 freight cars for the Pittsburg & Lake Erie Railroad.

The Barney & Smith Car Co. are building one passenger coach for the Pittsburg & Lake Erie Railroad.

The Baldwin Locomotive Works are building four six-wheel connected engines for the Rio Grande Western.

The Toledo & Ohio Central are having a large order of freight cars built by the Michigan Peninsular Car Co.

The Barney & Smith Car Co. are engaged on the construction of ten cars for the United States Express Co.

The Astoria & Columbia River Railroad are having 103 freight cars built by the Ensign Manufacturing Co.

The Pittsburg Locomotive Works are building twelve consolidation engines for the Chicago & Eastern Illinois.

The Louisville, Henderson & St. Louis Railroad are having fifty freight cars constructed by the Ohio Falls Car Co.

The Barney & Smith Car Co. are engaged on 24 passenger cars for the Astoria & Columbia River Railway.

The Pittsburg Locomotive Works are building one six-wheel connected engine for the South Atlantic & Ohio Railroad.

One hundred freight cars are being built by the Ohio Falls Car Company for the South Carolina & Georgia Railroad.

The Brooks Locomotive Works are building twenty-five locomotives for the Finland State Railway of Northern Russia.

The Baldwin Locomotive Works are building two six-wheel connected engines for the Fort Worth & Rio Grande Railway.

(Continued on page 850.)

Quick Bridge Work on the Pennsylvania Railroad.

The Pennsylvania Railroad never does things by halves, and its latest engineering feat is ahead of anything we have ever heard of, reflecting great credit on its engineers.

The bridge across the Schuylkill River, just above Girard avenue, in Philadelphia, is composed of four stone arches, two on each side of the river, and a steel span of 242 feet between them over the river.

The original bridge was built in 1868, and since that time the traffic has increased to such an extent, both in frequency and weight, as to make a new span necessary. As this is one of the busiest portions of the Pennsylvania Railroad, and as they always make it a point never to delay a train if it can be avoided, the problem of putting in a new bridge was a serious one.

It was satisfactorily solved as follows: False work was built on each side, and in front of both piers next to the span, and the new steel span was put together beside the one it was to replace.

The new span has nine sections, and was entirely put together so as to be moved bodily in place as soon as the old one could be removed.

Sunday, October 17th, was chosen as the time, on account of fewer trains than on week days, and at 2:53 P. M. the last train, a Chestnut Hill accommodation, passed over the bridge. The last car had just passed over when workmen began tearing away the connections between the span and the pier, and in four minutes the order to move was given. Two hoisting engines with the necessary ropes and tackle started to work, and in two minutes and a very few seconds the old span was out and the new one in place, three minutes more being used to adjust the rails and connections. In twelve minutes after the passage of the last train a special, carrying the engineers, went over, and not a regular train was delayed.

The old and new spans were moved together to save time, and a total weight of over 1,700 tons was handled at one time, the old span weighing 750 and the new span 970 tons.

When it is considered that the span was 242 feet long by 20 feet wide, and was 40 feet above the river, an idea of the difficulties to be overcome can be obtained.

We were fortunate in being able to have a photographer on the spot and to obtain a photograph of this in time for this issue. The view shows the last trains passing over the old bridge and the new span ready to be moved into place as soon as the old one was out. A good idea of the truss for supporting the new span is also given.

BRIDGE READY TO MOVE INTO PLACE.

In spite of the conclusions of naval architects, that it was impossible for a boat carrying its own motive power to glide on the surface of the water, a French engineer, Count Lambert, of Versailles, determined to try it himself, and succeeded to quite a remarkable degree, considering that the engines were not adapted to the speed necessary. There are two hulls connected by metal tubes and four blades, which support the boat when running. The boat has attained a speed of over 20 miles per hour, and with proper engines it is confidently expected that this will be materially increased. It is, of course, only intended for smooth waters. This shows that "authorities" are sometimes mistaken and retard progress by being accepted as final.

Car Department.

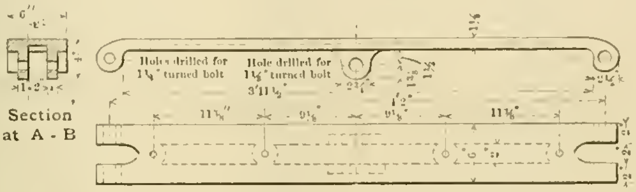
CONDUCTED BY O. H. REYNOLDS.

Northern Pacific Steel Body Bolster.

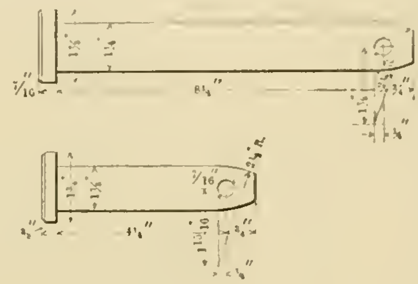
A mechanical creation in the way of a body bolster, and one that shows originality in design, is presented herewith. In many respects this bolster stands alone and apart from the great grist of schemes ground out with the laudable intention of improving on the old order of things; the majority of these dreams, as is well known by those who have kept in touch with the subject, have been rank failures.

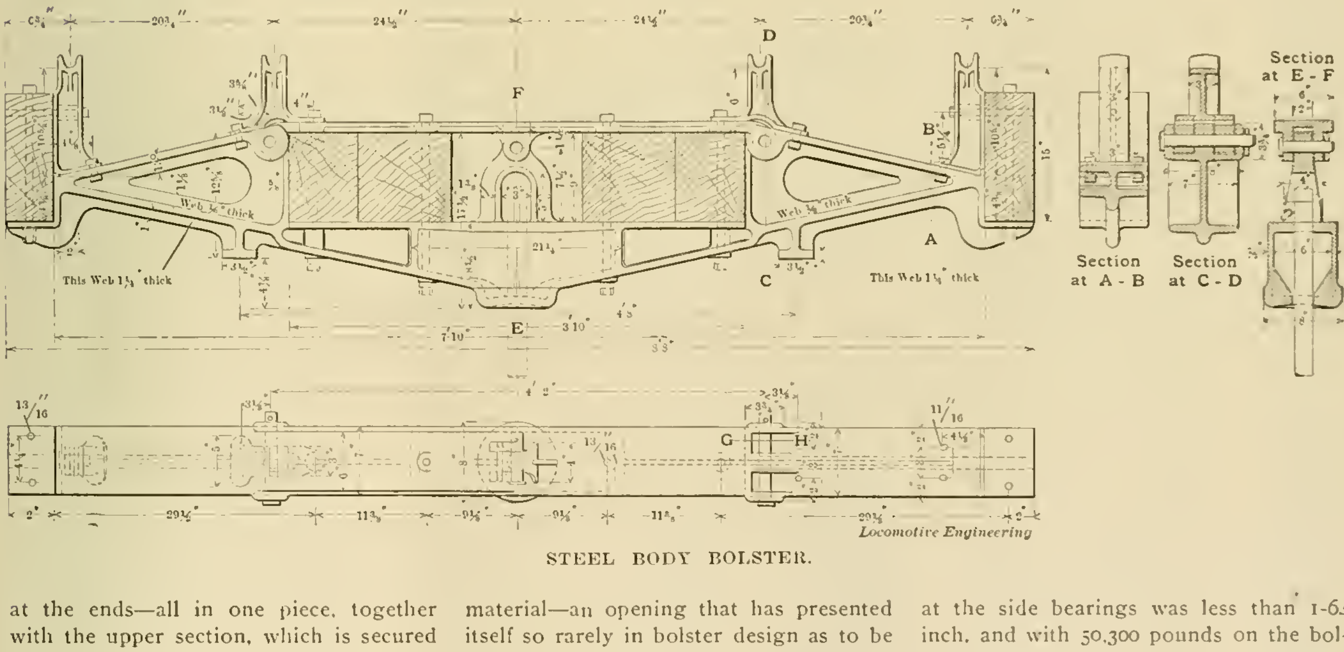
This bolster is of soft open hearth steel, consisting of only five parts, namely, the lower section which embraces the center bearing, the side bearings and the lip without increasing the hight of the car body. This is practically, therefore, 8½ inches deeper than the old bolsters, which were made of two plates, the top one of which supported the sills, thus restricting the distance between the body and truck bolsters, and right here is seen the reason why the shallow bolster is weak—there is not room enough between the bottom of the sills and truck holster to get in a section with the proper resisting moment.

An examination of the lines of this bolster will make it plain that full advantage is taken of the opportunity to get the strength with a minimum amount of section is seen at the center for a distance of 21¼ inches, and the remainder webbed and cored, with the result that there is no one point weaker than another; the shape of the section being made with the one purpose of equalization of fiber stresses in view, for the whole length of bolster, with a distributed load. A test of the strength of one of these bolsters under a static load applied at the outer ends, and therefore much greater than if uniformly distributed, was made in a hydrostatic machine, with the result that with 65,416 pounds of load, the deflection at ends was 3-16 inch, while the deflection



DETAIL OF BOLSTER TOP





STEEL BODY BOLSTER.

at the ends—all in one piece, together with the upper section, which is secured to the lower by means of three steel pins through the jaws at either end and at the center. The truss rod bearings are of malleable iron and bolted to the bolster, which was in this case designed for the 70,000-pound twin hopper coal car.

In order to get sufficient depth at the center, and a section that would resist the stresses without deflection, the pin construction in the tension member was adopted. By its use the sills pass through, the top of bolster becoming the floor line, and a depth of 18⅝ inches from the face of the center bearing to the top is obtained material—an opening that has presented itself so rarely in bolster design as to be worthy of rather more extended comment than it is likely to receive, simply because it has failed of recognition so long; the sole aim of the experimenter in this field being, to judge from results, to make the old bolster go by means of filling pieces between the upper and lower plates. How well they have succeeded is best known to those who have failed.

The difficulties of having any desired section for a given load are surmounted by the use of a casting of steel. How the material is disposed is clearly shown in the three sectional views, in which a box at the side bearings was less than 1-64 inch, and with 50,300 pounds on the bolster there was no deflection whatever at the side bearings.

To get these figures, it was necessary to make the machined fit between the shoulders of the tension member and also of the pins which were turned and driven into reamed holes; the pins being also of steel, 1⅝ and 1¼ inches, respectively, at the center and ends of the tension member. The design of this bolster was worked out by Chief Draftsman Posson, in the office of Mechanical Engineer Thompson, of the Northern Pacific Railway.

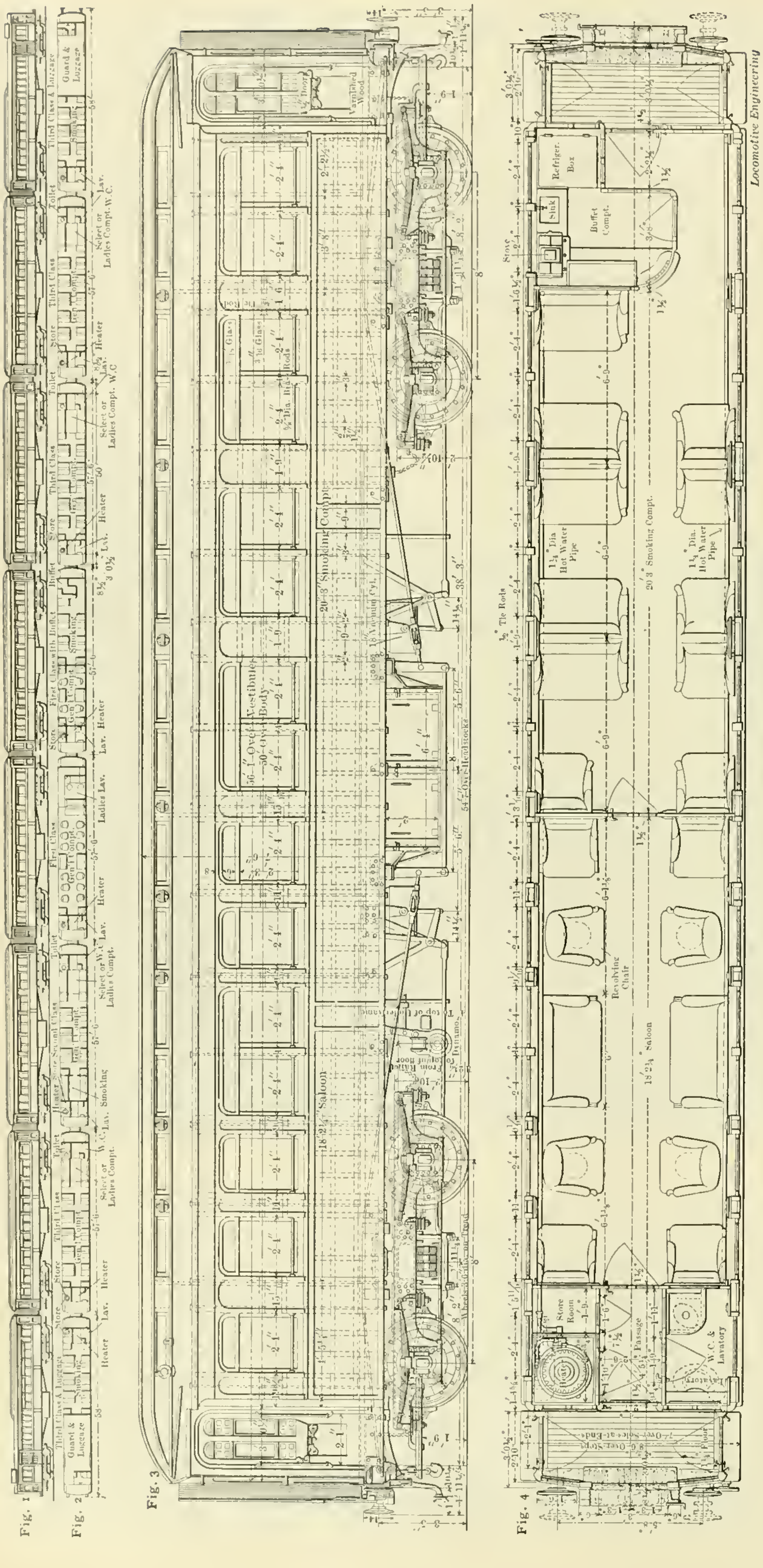


Fig. 1 Fig. 2 Fig. 3 Fig. 4

VESTIBULED TRAIN OF SOUTHEASTERN RAILWAY.

Vestibuled Train of the South-Eastern Railway.

The South-Eastern Railway of England has made a long stride in advance of past and existing practice on foreign railroads by placing on its line the new vestibuled train shown in our engraving. Eight cars comprise the train, which is made up as partly shown in Figs. 1 and 2—which takes in the full train—in which a combination baggage and smoking car is at either end, with the first-class cars in the center and the second and third-class cars between. Fig. 3, the elevation of the first-class car, is so much of an American in appearance, that if put in one of our trains, it would not be easy to tell that it was built in England, and the illusion would still hold if we should pass into the car and see it as shown in the plan, Fig. 4, in which is seen the buffet and smoking compartment, the saloon or lounging room, the hot water heater and the lavatory.

The finish and decoration of the first-class car is of the period of Louis XV, while the woodwork is of Italian walnut, heavily carved and with esthetic gilding. Mirrors between the windows, surrounded by white and gold ornamentation, lend a satisfying air of luxury in perfect keeping with the general finish. Basket racks above the seats are not forgotten in the effort to have no conveniences wanting. The lighting is provided by a dynamo under each car, operated from the axle. An independent hot water heater is provided for each car, and ventilation is had by means of air extractors in the clear story. The car being so nearly like our own product, it is proper to assume that fresh-air fiends will be in attendance as with us, to torture and drive mad the thin-blooded contingent, by keeping windows raised. The seats, it is seen, come under the head of parlor-car practice, which has been found to bring discomfort to the seat hog, who waxes fat over here, because our coach seats, by their arrangement, encourage his selfish instincts.

While of about the same length as the American car, these cars are somewhat narrower, the decreased width being made necessary by reason of narrower tunnels than ours. In the matter of sills these cars furnish an object lesson in light construction, with their six longitudinal sills, four of which, the center and intermediate, are wood and the outside of steel angles, 4 x 9 x ½ inch, all continuous to the platform end sills, thus forming platform sills in themselves. The outside sills are closed in for a length of 27½ inches from the ends, to a width of 7 feet over all, making the platform 3⅝ inches narrower than the width over sills. Just why this was done is not clear from the drawings; if from considerations of station platform space we may look for the reasons, it is explainable; but if viewed from the finish standpoint, the straight sills and flush vestibule would have been neater in appearance. The Challender truss of ⅛-inch steel plate runs full length of the car, extending from the belt rail to the sill, to both of which it is riveted, and also screwed to the posts.

Train is fitted with the telescopic corner buffers, which are used only when the cars may happen to run in a train fitted up with the old-style buffing appliances. This train has the Gould coupler and buffer, and the dotted and full lines of the corner buffers, as shown in Fig. 4, give their relative positions when running as buffers, or backed out of position to leave the vestibule to do the buffing. Fox steel truck frames are used with 42-inch wheels. Two 1¼-inch truss rods having turnbuckles are connected in a peculiar manner to the truss-rod posts, presumably for letting in the supply box at the center of the car.

In all essential particulars this train reflects credit on the management that can tear itself loose from the traditions so long and tenaciously held in the matter of car construction, and the "Gordian knot" of conservatism once cut, improvements in rolling stock will come fast enough. The case under consideration is evidence of what can be done when the best features of English and American practice are combined, as in the Continental Express of the South-Eastern. For the particulars and engraving of this train we are indebted to "Engineering," of London, England.

Car Harems.

One of the questions that agitated Cairo last winter, says a writer in the "Cosmopolitan Magazine," was, How can the street railway company be compelled to curtain more effectually the trolley-car harems? A large part of the city, and by no means the European section exclusively, is served by a rapid transit system. The cars do not differ materially from the open cars employed on American lines, but the rear seat is reserved for women, instead of smokers, and its use is indicated by curtains that might be drawn, but in practice are not drawn, at the sides. There is no curtain in front to divide the harem from the other seats, and on an important route, like that, for example, from the Ezbekiyeh through the Boulevard Méhémet Ali to Old Cairo, the ceaseless chatter of its black-cloaked, black-veiled occupants, regardless of the silk-robed men in front and the red night-capped hangers-on at the sides, gives a hysteric suggestion of a picnic attended by masked mourners.

Many of the solid Moslems of Cairo are disquieted by the publicity of the street-car harems, and their feelings are understood, and to some extent shared, by a few of the Anglo-Egyptians of the second and third generations. The short line of the Constantinople underground railway is more mindful of Moslem customs. The harem divisions of its cars are fully curtained; but these divisions are too small to hold the women who flock from the Galata-Pera sections during shopping hours to the bazaars of Stamboul, and there is usually an overflow in the main part of the car. No seats are provided, and the privacy of the Turkish woman, homeward bound at sunset, after a war of wits with the stately diplomats of the Oriental bargain counters, is comparable to that of the standing throng in a rush trip on a Brooklyn Bridge car.

Truss Rods, Side Bearings and Bolsters.

At regular recurring periods those following up railroad literature are treated to long-winded dissertations on the improvement of rolling stock design. There are stock recommendations for standard parts duly labeled and pigeonholed for future use, embracing such details as sills, bolsters, truss rods and side bearings—all for consideration in the abstract or otherwise as befits the occasion. While all interested are obliged to concede the necessity for hammering at these standbys, there is a certain vague feeling that a great part of the energy expended would be productive of better results if the proposed improvements could in all cases emanate from practical sources.

It has been discovered again that body bolsters are weak, and go down to a solid bearing on side bearings, with the usual disastrous outcome to wheel flanges. In one instance the proposed remedy for this trouble is to use a side bearing as nearly frictionless as possible and carry the load there, losing sight of the fact that car history is one long record of failures to devise such a bearing. The unmistakable lesson conveyed in shifting the load from the bolsters to the side bearings is that the former is the place to rectify errors in design.

Bolsters can be, and are, designed to stand up under any required load, and that, too, without excessive weight, for both body and truck. If cost of maintenance of rolling stock were traced to its proper source, and each part charged up with its rightful contribution to the account, more thought would be given to the question of bolsters than they have received in the past, and side bearings would be a dead issue. A weak bolster can serve only one useful purpose, and that is to show up the incompetency of the man that wasted his time in giving it form and striving by every subterfuge known to the art of car building to make it go.

No aid from the framing need be looked for to help a bolster do its work; it must stand alone, but it can be assisted to do this very materially by a proper arrangement of the truss rods—a fact that appears to be little understood. We may make the general statement that the truss rods carry all of the load coming between the bolsters, since that part of it sustained by the sills and superstructure framing is so small as to be practically a negligible quantity, if the car is assumed to be built as light as it should be. This being the case, the load sustained by the rods is deposited at the bolsters, and the point at which this occurs is of the greatest importance as affecting the strength of the bolster. This will be understood when the difference in bending moments between a load at the end of the bolster and one near the center is considered. At the end it is greatest; at the center it is zero. This, it is seen, furnishes the best of reasons for placing the outside pair of truss rods as near the intermediate sills as possible, and not at the outside sills, as is done in almost all cases.

Any attempt to shift the function of the truss rods to the sills cannot be productive of anything but loss in the end. Sills are, as a rule, too heavy, for which we are indebted to the practice of the past when those members were not assisted by a truss. Recourse must be had to other means than by these, to hold up the loads of the present day equipment, and a light construction simply means a strong bolster and proper rod trussing.

A bolster designed to stand up under a static load will not take a permanent set under the shocks of service, and while a certain, or rather an uncertain, amount of deflection will be present, the side bearings are easily arranged so as to avoid contact in such a case without impairing the stability of the car on curves, by a reduction of the contact faces so as to clear under the greatest deflection of the bolster. Deformation under load exists in every bolster thus far built, and since stiffness is only comparative, the question narrows itself down to a deflection within the elastic limit of the material; when that is done side bearings may profitably receive attention as to their proper relation to bolsters.

Imperceptible slip has been found to be .04 of one per cent. on engines, in test at the Chicago & Northwestern testing plant; that is, the revolutions of the wheels were that amount greater than the revolutions recorded on the counter of the plant. A gain of one revolution in 400 is a strikingly small amount, much smaller, in fact, than it was supposed to be prior to the accurate demonstration of it with instruments of precision.

How to Make Heavy Repairs on the Locomotive Boiler.

BY HENRY J. RAPS.

When the boiler has been in service from three to five years, a large number of the heads of stay-bolts in the lower portion of fire-box will be found completely fatigued or burnt out from exposure to the intense heat of the fire. Although the washing-out has been as thorough as possible, a small ring of scale has gathered around the inner end of stay-bolt ½ inch larger than diameter of bolt, and become as hard as stone. As it is impervious to water, it naturally helps to increase the temperature of sheet and bolts, and consequently is, in part, the cause of the fatigued condition of the stay-bolt heads. Here and there a head will be found which has the life completely burned out of it around the edge; if a chisel is inserted under that portion of the head which is hammered over the sheet, it will crumble like so much burnt cast-iron. An occasional leaky bolt will also be found that has been caulked so much that it is about lifeless.

As a rule, very little attention is usually paid to the stay-bolts in the lower part of fire-box. If they are tight, that is thought to be sufficient reason for not disturbing them; in some shops the practice is to rehammer the bolts when they arrive at this condition, but this is a makeshift and a bad practice, as the bolts will not remain tight for a reasonable length of time. The proper plan to follow is to remove all the bolts which have the heads burnt or which have been leaking, and replace them with new ones. There will probably be 30 to 40 in either side and 10 to 15 in either end which will need renewing; they should be drilled from both sides when being removed, using an air motor to furnish the power. Holes should not be tapped larger than necessary, 1-32 inch larger will usually suffice. The renewing of stay-bolts in the lower part of fire-box is a very important feature in the repair of the locomotive boiler, and should not be neglected, as by it the life of the fire-box will be doubled.

It may be that by this time the door-hole has developed a number of cracks at the bend, on account of too much lap on inner flange, builders sometimes leaving as much as 1½ inches from center of holes. This keeps the water away from outer flange. It also leaves a very small space between the edge of inner flange and bend which is very soon filled up with scale, causing overheating and cracking.

If the number of cracks is large enough to warrant it, the outer flange should be cut out and a new door ring put in. If possible, the old flange should be cut out just inside the bend, so that the seam will come inside the stay-bolts. The excessive lap on inner flange should be reduced to ¾ inch from center of holes. A number of points in the edge of inner seam should then be located on the back sheet with a pair of dividers, making witness marks with a center punch. This is done for the purpose of locating the edges of seam on the new piece. When the new piece has been flanged and annealed, it should be put in place and the edge of the seam marked off from the witness marks previously made on back sheet The holes are then laid out ¾ inch from this line and 1¾ inches center to center. The piece is taken out, holes punched or drilled, the edge trimmed ⅞ inch from center of holes, patch replaced and holes drilled in old sheet through the holes in new piece, the holes in flange are then marked with a scratch-awl through the holes so drilled, the patch is again removed, holes in flange punched or drilled, and the same process is then gone through with as with patch-bolt patch described in October number. Should the mud-ring be removed at this time on account of the renewal of side sheets, the greater part of the same may be riveted.

Should it be necessary to extend the patch beyond a number of the stay-bolts around door-hole, the stay-bolts should not be put in seam. If the staybolt holes are so located that they will come in the seam, the holes in inner sheet should be used for patch bolts or rivets, as the case may be, the outer holes plugged and bolts located at least 2 inches from holes in seam. Should it be necessary to remove a number of bolts around door-hole, the holes may be utilized for the purpose of marking off the holes in flange and also the edge of seam on inside.

In flanging the door-hole, the radius of bend should be made as large as possible in order that it may adapt itself to the various changes produced by expansion and contraction—due to the variations of temperature—without cracking.

After six or eight years of service it will be necessary to remove the lower part of side sheets in fire-box and probably the back tube-sheet. The horizontal seam of the half side-sheets should be located above the swell where it will give better results, on account of being removed from the intense heat of the fire. The sheet should be cut just above a row of stay-bolts with cape-chisel and ripper, the rivets in vertical seams and mud ring are

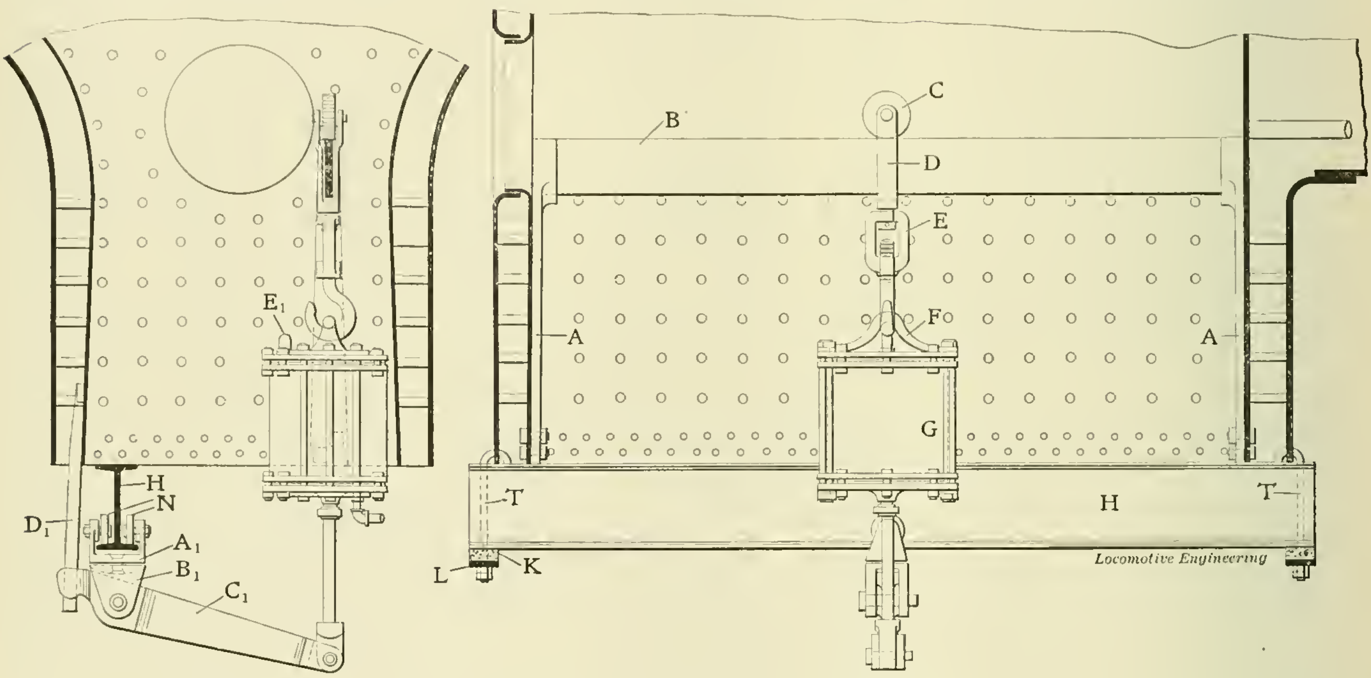


Fig. 1 Fig. 2

STAY-BOLT CUTTER.

then cut out, mud ring removed, stay-bolt heads cut off, bolts drilled and broken, and the sheets removed.

The upper parts of sheets are straightened, the outer row of stay-bolt ends punched out, the old sheets are laid upon the new and holes marked off with a marking punch made of round steel the size of holes and having a raised center.

The horizontal seams should be lined off 1 1-16 inches from edge of old sheets, allowing 5-16 inch for thickness of chisel; this makes the lap on inner sheet of seam ¾ inch from center of holes. The first hole in seam should be 2 inches from vertical seam, in order that there will be ample space next to flange for driving the rivet; the balance of holes should be spaced 1¾ inches center to center. When the holes are marked, the old sheets are removed and stay-bolt holes lined off with a chalk line and marked with a center punch. Before this is done, however, it should be ascertained whether or not the staybolt-holes are in alignment. If not, they should be adjusted.

All holes should be punched, punching holes for upper seam ¾ inch for 11-16 inch rivets, stay-bolt holes should be punched ⅛ inch smaller than diameter of bolts. The edges of sheets are then trimmed, allowing ⅞ inch from center of holes at ends and top, and 1⅛ inches to 1¼ inches on bottom, according to location of holes in mud ring. The corners of sheets are then scarfed and sheets annealed, straightened in the rolls, the upper part rolled the required shape, the sheets put in place in the fire-box, and the holes in upper seams drilled, using an air motor to furnish the power. After drilling, the sheets are removed and burr removed from inside of upper holes in old sheets with the burr reamer illustrated in Fig. 3, which may be made of an old flat file, a wooden handle inserted in the eye. The holes in flanges are countersunk, all excessive lap removed from edge of flanges, reducing it to ⅞ inch from center of holes.

The upper holes in new sheets are countersunk half way through, oil and burrs removed, sheets again put in place and riveted. A forked wedge bar should be used to hold on rivets in upper seams, avoiding the necessity of cutting out the row of stay-bolts above seam, as the bar will straddle the stay-bolts.

A rivet button, as illustrated in Fig. 4, should be applied to the rivet head, and the wedge bar inserted between it and outer sheet. There should be a number of these buttons of different thicknesses, adapted to the difference in width of water legs; they should be made of steel, with ⅜-inch iron handle.

A "laying up" button, as illustrated in Fig. 5, will be found very serviceable for those parts of seams that are not close enough to be brought in contact by driving the rivet. There should be a number of these also, of various thicknesses, made of steel. They should be inserted in the hole when necessary, with a pair of tongs, the wedge bar inserted and the seam hammered around the hole. When the work is under way this button should be applied just after the rivet has been plugged, as, if its use is put off until rivet is finished, the rivet is liable to be loosened when sheet is hammered at the hole.

When the upper and end seams have been riveted, the mud-ring is put in place and riveted, the corner holes in box should be countersunk and rivets drove inside. Unless the mud ring is an extra heavy one, the sides will be sprung out from ¼ inch to ½ inch. It should be straightened by heating it all over in a wood fire and drawing it together with rods. After riveting mud ring, the outer sheets are straightened by inserting rods and drawing them together, the stay-bolt holes are then tapped, bolts put in, cut off, and hammered over, the seams are chipped and caulked, finishing the operation.

Should the fire-box be a shallow one, it will be found more profitable to cut out the whole side-sheet and renew it; as, by putting in a half sheet, the upper seam is brought too near the intense heat of the fire and soon begins to leak, eventually developing cracks.

It is customary in some shops to renew side sheets without removing mud-ring, especially in boilers that extend over the frame. In such cases, unless there is ample room in water space to hold on the rivets from the shell, the sheet is sprung away from the mud ring. The rivets in back seam and the greater part of the upper seam are held on from below, the balance are held on from the shell.

The most tedious and laborious part of renewing side-sheets is the breaking of stay-bolts. For the purpose of overcoming this, and to break the bolts more expeditiously, the stay-bolt breaker shown in illustration was designed.

Fig. 2 is a side elevation showing the supports *A A* bolted to end sheets of fire-box through mud-ring holes; these supports have a jaw at upper end to receive the bar *B*, which serves as a track for the carrier, consisting of a 5½ x 1½-inch sheave *C*, stirrup *D* and swivel *E*; the hook of swivel engages with the yoke *F*, which is bolted to a 12 x 12-inch driver brake cylinder *G*. *H* is an I-beam fastened to bottom of water-leg with two hook-

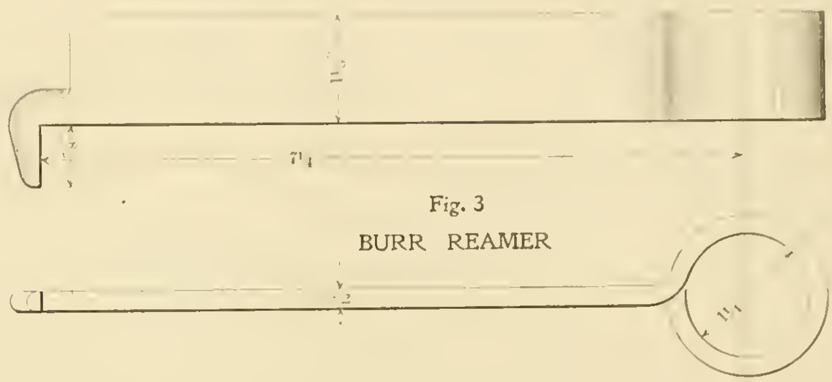


Fig. 3

BURR REAMER

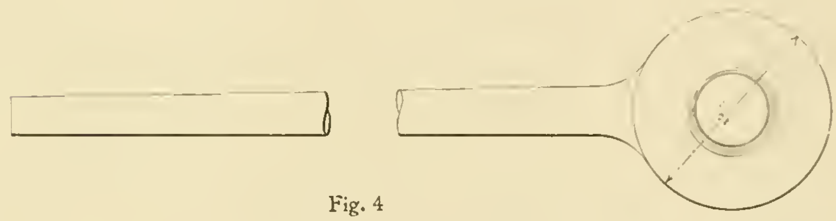


Fig. 4

RIVET BUTTON

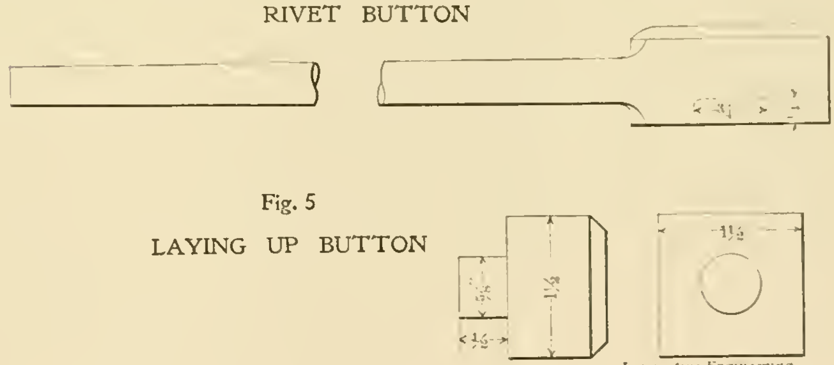


Fig. 5

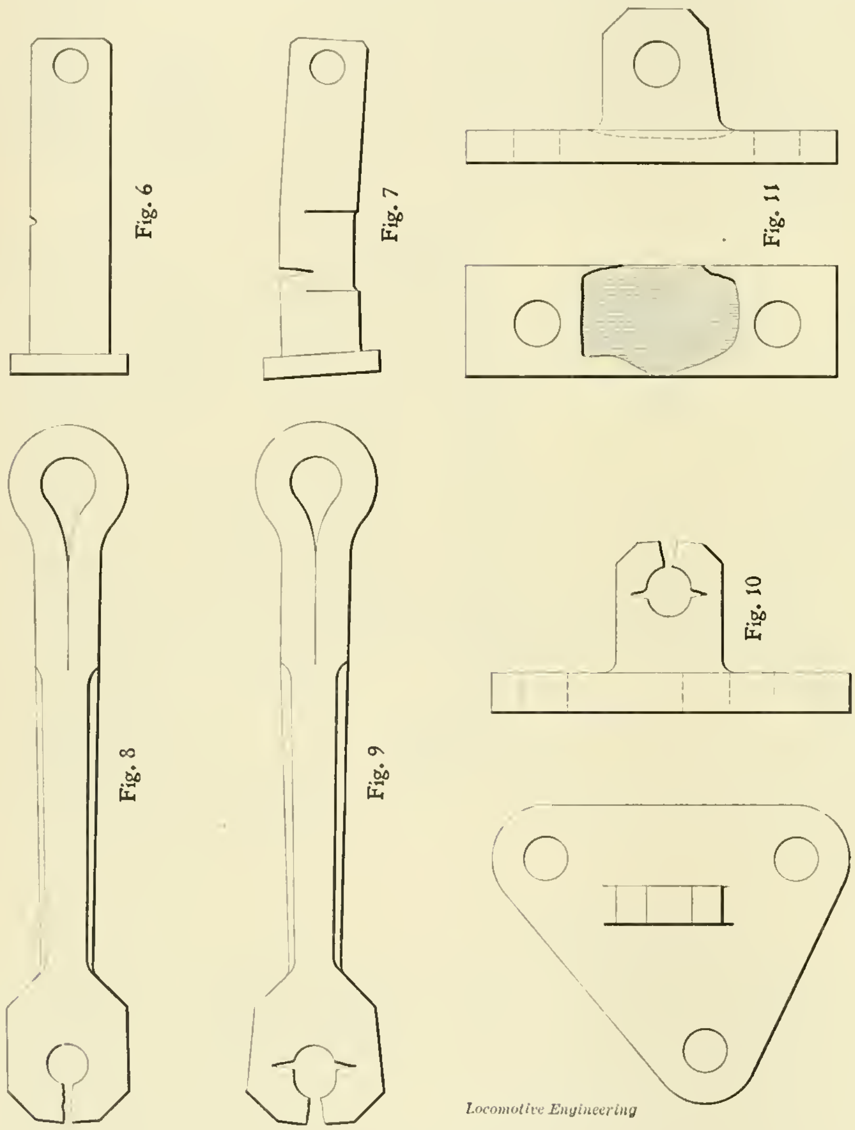
LAYING UP BUTTON

bolts *T T* at either end, a piece of rubber *K* to cushion the recoil and a strap of iron *L*.

Fig. 1 is an end elevation showing a section of the I-beam *H*, on the lower flange of which the traveling fulcrum is suspended, consisting of two 2½ x ⅝-inch sheaves *N*, and two stirrups A_1 and B_1, which are connected by a rivet which allows them to turn on one another as desired; the lever C_1 is hung in the stirrup B_1 with a 1½-inch pin, the long end of lever C_1 is connected with the piston rod, the short end of lever terminates in a downwardly projecting nose rounded on the bottom; it is bifurcated or forked so as to straddle the T-headed breaker-hook D_1, made of 1½-inch steel. The upper side of head is concaved so that when in operation the hook and lever cannot disengage. The hook is beveled on the inside to give it a cutting as well as breaking action. The breaker-hooks are made of various lengths to suit the location of stay-bolts, any slight variation is made up by inserting a mule-shoe between the head of hook and lever. A mule-shoe is shown in the details.

In the upper cylinder head is placed a check valve E_1. It contains a small valve and a coiled spring just strong enough to support the valve. When the piston descends air is drawn into the cylinder, the air is compressed when the piston ascends—forming an air cushion to counteract the shock when the bolt breaks.

Compressed air is the power used. It is admitted and exhausted through a three-way cock.



DANGEROUS DEFECTS.

Should the back tube-sheet need renewing at this time, a pattern should be made for it of 16 or 14 sheet steel. (provided there are a number of boilers of the same class,) the tube holes, stay-bolt holes, brace and mud-ring rivet holes should be located on pattern as well as flange and shear line. The mud-ring and brace rivet holes, stay-bolt holes, and holes for tit of tube hole counterbore should be punched in sheet before flanging. After flanging, the lower corners should be shaped to fit mud-ring. The sheet is then annealed and holes marked on flange, either by putting sheet in place and marking with a scratch awl or by transferring the location of holes with a piece of hoop iron. The holes in flange are either drilled or punched, then countersunk, the tube holes counterbored, the straight parts of flange beveled in planer, the balance chipped. The lap on lower part should be ⅞ inch from center of holes, upper part 1 inch. After cleaning off all oil and grit, the sheet is put in place and riveted, stay-bolts put in, cut off, hammered over, and the sheet chipped and caulked. When putting on the braces a piece of 1-inch pipe 1 inch long should be put between brace and tube-sheet.

All the braces in the boiler should again be examined. The method often followed of testing braces with a hammer and pronouncing them in good condition if they are taut, is not thorough enough. A brace may be taut and have a dangerously corroded pin, as shown in Fig. 6, or the pin may be cracked, bent, or partly sheared, as shown in Fig. 7, or the brace may be cracked out at the hole, as shown in Figs. 8 and 9. The brace may be taut with the end of crow foot cracked out from the hole, and the hole elongated in consequence, as shown in Fig. 10. This is especially true of the end-sheets, that is, the front and back heads, as they will spring outward as the hole elongates, assuming a permanent set.

When the boiler has been in service from four to six years a number of broken crown-bar braces will be found. Should the brace extend down into crown bar, without the intervention of a link, they are not readily detected, as they are usually solidly imbedded in scale, and will sound as solid as though they were a part of the crown bar. Figs. 8 and 9 are braces of this description; these braces should all be removed for examination and new brace pins put in when they are replaced.

The braces which were fastened with brace pins shown in Figs. 6 and 7, the braces shown in Figs. 8 and 9 and the brace which was fastened to the crow foot shown in Fig. 10 were all taut; the affected parts would not have been discovered had braces not been removed. This is certainly conclusive evidence that testing braces with a hammer—by the sound test—is inefficient and unsafe, and that all braces should be removed for examination at regular intervals.

Fig. 11 is an illustration of a crow foot which was made of two pieces with a jumped weld, and shows the danger of using a brace of this description, as they will invariably pull apart at the weld, as shown in illustration.

In many instances the principal desire of the boiler maker is to have the fire-box and tubes tight, the condition of braces and stay-bolts being a secondary consideration. The braces and stay-bolts of a boiler in good condition should receive more attention than those in a leaky boiler, as the maximum pressure is a more constant factor in the tight boiler than in the boiler that is leaking, subjecting the braces and bolts to a greater strain.

The old saying of letting well enough alone is often applied to a boiler which outwardly, at least, is in good condition. A boiler is not good enough until all its parts have been not only thoroughly inspected, but also their strength calculated and found to be sufficient. Should the inspection or calculation prove any part of the boiler unsafe, it should be put in good condition. It is always more profitable to keep in mind the saying, "Better be sure than sorry."

Meeting of the New York Railroad Club.

The members of this club met at their rooms on the evening of October 21st, to listen to a paper entitled, "Application of Electricity to Standard Railroads," but were disappointed in the failure of the author to appear. Proposed amendments to the by-laws were read, among which it was provided that papers for discussion should be in the secretary's hands sixty days before presentation for discussion; papers should be read by abstract only, and the reading should be confined to ten minutes; extempore discussion confined to five minutes, and the rules to be suspended at any meeting.

Mr. Brangs moved to accept the rules as read. Mr. Sinclair cited the action of the Master Mechanics' and Master Car Builders' Associations in like cases, expressing his belief that the members should pass on the amendments in the usual way, and on coming to a vote they were unanimously passed. The subject of electricity applied to standard roads was opened by Mr. Scheffler, who explained how, a few years ago, while he was with Mr. Edison, they were called upon to design an electric locomotive to haul wheat in the West. This experiment developed 15 horse-power by the motor belting down to a countershaft which had a belt running to a pulley on the driving wheel. Leakage of the current killed the motor, and the road was never built.

The speaker did not think ten years ago that it was advisable to use electricity on steam railroads, but he had changed his opinion, and now thought there was good reason to believe such roads could be so operated. His reasons were that the three-phase system would do it, because of the high voltage possible, thus reducing the first cost of the copper and carrying the current a longer distance, provided motors could be designed to carry the high tension. He was confident it was capable of being figured on the lines proposed.

Mr. Brangs was not of those who believed that electricity would supplant steam—except, perhaps, in suburban traffic and on the elevated roads. He thought small roads running eight or ten trains a day could be used admirably as feeders for steam roads, if steam were abandoned and electricity substituted on the former. The traffic of the New York, New Haven & Hartford Railroad had been increased over 50 per cent. by this means. A laughable picture was drawn, in the comparison of a heavy engine with one or two cars competing with a properly equipped electric service, making the engine an object of ridicule under the conditions.

Mr. Strong gave his reasons for belief in electricity as a motive power, telling of loss of steam road traffic to electricity in Philadelphia, from which the inference was easily drawn that the electric people had builded on the right lines to get the business. The wonderful efficiency of the gas motor was dwelt on by the speaker, who made the statement that these motors were in operation in Germany at a cost of but 25 per cent. of the electric motor in America, giving a horse-power hour on a coal consumption of ½ pound, while 10 pounds of coal per horse-power per hour gave only about 45 per cent. of the power delivered to the wheel by electricity. Long-distance running with a locomotive, it was believed by the speaker, could be done with an expenditure of less than 2 pounds of coal on the axle per horse-power per hour. The locomotive can be designed to do this by means of high steam pressure and a great number of expansions, whereas it is now giving an evaporation of less than 10 pounds of water per pound of coal.

Mr. Hutchinson, the gentleman who was to read the paper that failed of presentation at the meeting, thought that no figures had yet been seen like those cited by Mr. Strong, and spoke in defense of electricity when it was applied correctly for the work it had to do, and mentioned the heavy electric locomotives of the Baltimore & Ohio Railway in the tunnel service, with their draw-bar pull of 65,000 pounds. He believed that all feeders would be operated by electricity in independent units in ten years from this time, and not by electric locomotives, as now used; also thought that the application of electricity to trunk line service is not within gun shot at this time. As a foil to Mr. Brangs' heavy engine and light train, the speaker narrated an experience he had as an expert to pass on the case of a projected railroad in Mexico, where they proposed to use electricity generated by water power and transmit the same 30 or 40 miles to haul heavy freight teams on grades of 4 and 5 per cent. It was with difficulty that he could convince the projectors of the enterprise of the absurdity of their scheme.

The hight of draw-bars was next taken up, and Messrs. West, Appleyard and Mitchell each made it plain from recent observations on their respective roads, how easy it was for a car to be rejected by a government inspector after having been pronounced right by their own men, by simply moving the car a few feet on the track. The condition of the track had been found to exercise an important influence in the hight of the car after adjustment, and Mr. Mitchell suggested that it would be a good thing for all concerned if the government inspectors were accompanied by a representative of the railroad company when the question of correct hight was passed on. An adjournment was taken with the feeling that the evening had been profitably and enjoyably spent. The next paper before the club will be the "Effect of Brake Beam Hanging upon Brake Efficiency," by Mr. R. A. Parke.

The "American Machinist" has been for some time publishing a series of articles on "Locomotive Link Motion," by Mr. F. A. Halsey, associate editor of the paper. So much has been said and written about link motion and valve gears that we supposed the subject was nearly exhausted, yet Mr. Halsey has found out a great many things about link motion which are entirely new and make very interesting reading to those who like to study that line of mechanism. We understand that Mr. Halsey intends to combine these articles with his well-known book on "Slide Valve Gears" and make a comprehensive work on "Valve Gears and Link Motion."

The difference in specific gravity between water and oil was illustrated in a startling and disastrous manner the other day by one of the workmen of a large oil company. One of the oil tanks had become thin on top, and in walking on it, the top gave way, letting the man down into the oil. Had this been water, it would have been of little consequence, as the man would rise and clamber out. Not so with the oil, however, as it is lighter than the human body, and the man never rose, but drowned in the tank.

The cleaning of varnished surfaces is quite a problem, and while soap and water is cheaper than any compound, its use is often disastrous to the varnish, and it becomes an expensive economy. The varnish cleaner made by A. D. Aquart, of St. Louis, Mo., isn't as cheap as water, but it cleans the varnish and doesn't destroy it, making it cheaper in the long run, besides leaving a better looking car.

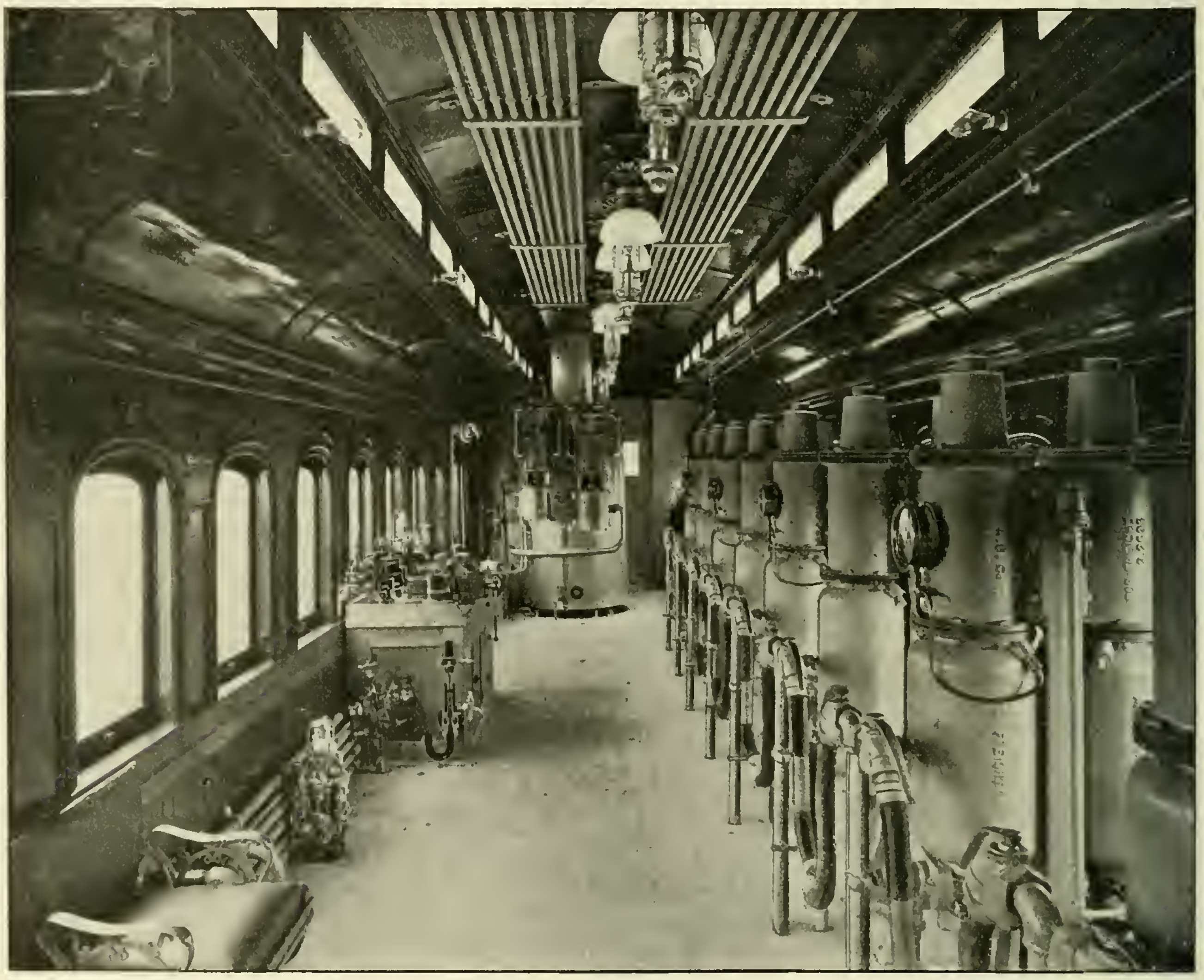
The refrigerator cars of the Baltimore & Ohio Railroad are to be painted white, with black lettering, a combination that should prove attractive

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

The Grand Trunk's New Air-Brake Instruction Car.

Through the kindness of Mr. Frank W. Morse, Supt. M. P. of the Grand Trunk Railway, we are enabled to illustrate their new air brake instruction car, recently constructed at Montreal. Briefly described, it is as follows:



INTERIOR VIEW OF THE GRAND TRUNK RAILWAY'S NEW AIR-BRAKE INSTRUCTION CAR, LOOKING TOWARD BOILER END.

Observe attachment of 8-inch and 9½-inch air pumps to boiler, which prevents annoyance from pumps when working. Notice the sectional views of lubricators and injectors.

Weight, 111,468 pounds. Inside dimensions: 9.0 high x 9.6 wide x 62.9 long.

The equipment of the car consists of eight-inch pump. nine and a half-inch pump, and all connections. The main reservoirs, which can be operated as one. or separately, when showing brake operated with engines double-heading. Three engineer's valves, E-6, D-5 and B-11. Driver brake complete. Tender brake. Twenty sets of freight brakes. One passenger brake. Full complement of pipe for each brake, located under floor, laid transversely. Fifteen sets of air signals, full complement of pipe, located overhead.

The car is provided with two Pullman sections, office and lavatory.

In placing the equipment care has been taken to avoid obstructing any of the windows. Also to obtain all floor space possible, therefore, the equipment is placed on one side of the car, with seats for the class opposite, as shown in the photograph. Provision has been made to accommodate twelve in each class.

To counterbalance the weight of the brake apparatus, the water supply, boiler and coal bin are placed on the opposite side. This balances the car.

For lighting the car is provided with oil lamps, and also electric fixtures. While instruction is being given to the classes, the electric light is furnished from a stationary power plant.

The accompanying photographs so clearly illustrate the many features of the car that further description would be superfluous.

"Doctor Standard."

Mr. Benj. Smith writes us, modestly declining to accept the entire credit of creating "Doctor Standard" and "Patient Railway," and desires that Mr. Amos Judd be credited with the part due him. Therefore, in justice to each, we will say that "Patient Railway" was introduced by Mr. Judd, to "Locomotive Engineering" readers, and to Mr. Smith belongs the credit of bringing out "Doctor Standard." Our thanks are due both gentlemen, for introducing these characters. They have enabled us to work off a little air brake history we have been wishing to unload for some time past.

The season for slid flat wheels is approaching, and the old saw, "An ounce of prevention is worth a pound of cure," should be borne in mind when making stops. Light reductions and careful use of sand while the brakes are being applied will often save more than one pair of wheels as well as a lot of correspondence. Remember, when using sand, to get it down while the brakes are applied lightly, and keep using it until the train stops. Dropping sand when wheels are sliding will not start them turning again. If you are running by a station with a full application of the brakes, don't drop sand unless it is a case of emergency, for at this season of the year it is probable that some wheels are already sliding.

There is a big pile of Conger's Air-Brake Catechism waiting for purchasers. It costs only 25 cents.

CORRESPONDENCE.

The Kicker.

Editors:

The following is a truthful report of an incident which really occurred, and is not fiction.

On almost every railroad in the country there is some one employé, or perhaps many of them for that matter, who is designated by the title given above. It was the writer's privilege to meet one of these, and he was so unique and withal such a good fellow that the idea occurred to me that perhaps the readers of "Locomotive Engineering" might also like to meet him. It is not my purpose to convey the idea that all "kickers" are always correct, but that it is well to investigate the matter before deciding, as in some cases the kick is well founded.

In introducing "The Kicker," I present him as Mr. John ——, engineer on the A. B. & C. R. R. (one of our trunk lines), and say for him that he is the kicker par excellence. He has three or four qualities which are combined, and are necessary, in a good kicker. He is generally correct, is always looking for information, can register the most vehement kick I ever witnessed, and what is more can keep it up; but if shown to be wrong, will acknowledge his error like a little man.

I was in the A. B. & C. roundhouse and asked an engineer, "Who goes out on 3?" "John ——," he said, "but don't ride with him, he'll kick your head off." That rather disheartened me at first, but I nevertheless decided to try it for a little while, and this is what followed.

I went to the depot and found John oiling round, watched him a little while and said, "Good evening, Mr. ——, how's she runnin'?"

"On the track, how'd you suppose?" he gruffly replied.

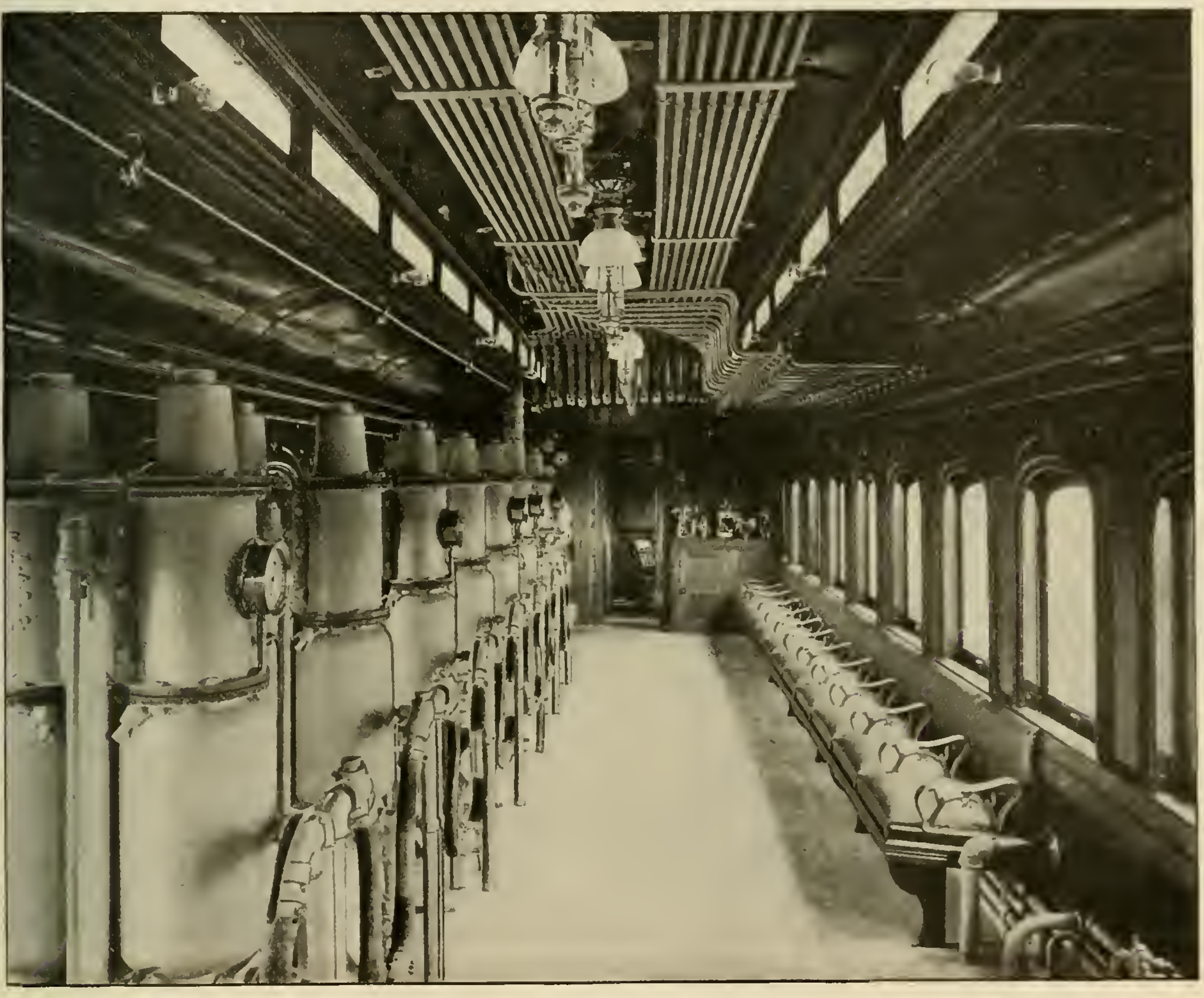
"Didn't know but she might be runnin' on the ties. I've seen 'em do it once in awhile. Say, that's a pretty nice looking pump you've got there."

"Are you one of them air brake fellers?"

"Yep," I replied.

"Get up here, I want to see you," said he.

I got up. "That pump out there that looks so nice ain't worth a continental



INTERIOR VIEW OF THE GRAND TRUNK RAILWAY'S NEW AIR-BRAKE INSTRUCTION CAR.
Showing arrangement of brake cylinders and comfortable seats for class while being instructed and examined.

cuss," he began. "Ain't been for the last two months, and won't be till its fixed as it should be. Won't make air enough to blow the flies off a sick horse. You needn't break in and tell me it looks like new. That don't make any difference. It's just been overhauled and all they done to it was to give it a new jacket, and buff the cap nuts and cylinder heads. I'd like to know what buffin' the outside of a pump has got to do with makin' air. Call that an overhaulin'?"

I admitted that I did not.

He then continued, "I went over to the pump room one day and told that feller it needed new rings in the air cylinder. Say, it ain't got suction enough to take a mint julep on a hot day. 'N that air pump feller told me he guessed he knew what it needed. Why say! I asked him if he had seen the report of the Air Brake convention at Columbus, 'n he told me that he didn't need any conventions to tell him what to do. Why, some of them fellers at Columbus forgot more'n he ever knew! He's been foolin' along with that pump for two months and ain't got it fixed yet. Gave the air valves more lift to let her get more air, so he said, and she pounded so bad she curdled the milk in the fireman's coffee. Then he came down and put new air valves in it. Cut the lift down, and it burnt the packin' out in no time and pretty near set the laggin' on fire. Then he finally put in new rings, 'n what do you s'pose he did? The durn fool just sawed a piece out of the ring and stuck 'em in there any old way. Didn't have sense enough to know they had to be fitted. That's the way it goes."

I remarked that it seemed strange that the man should be kept on air brake work if that was the case.

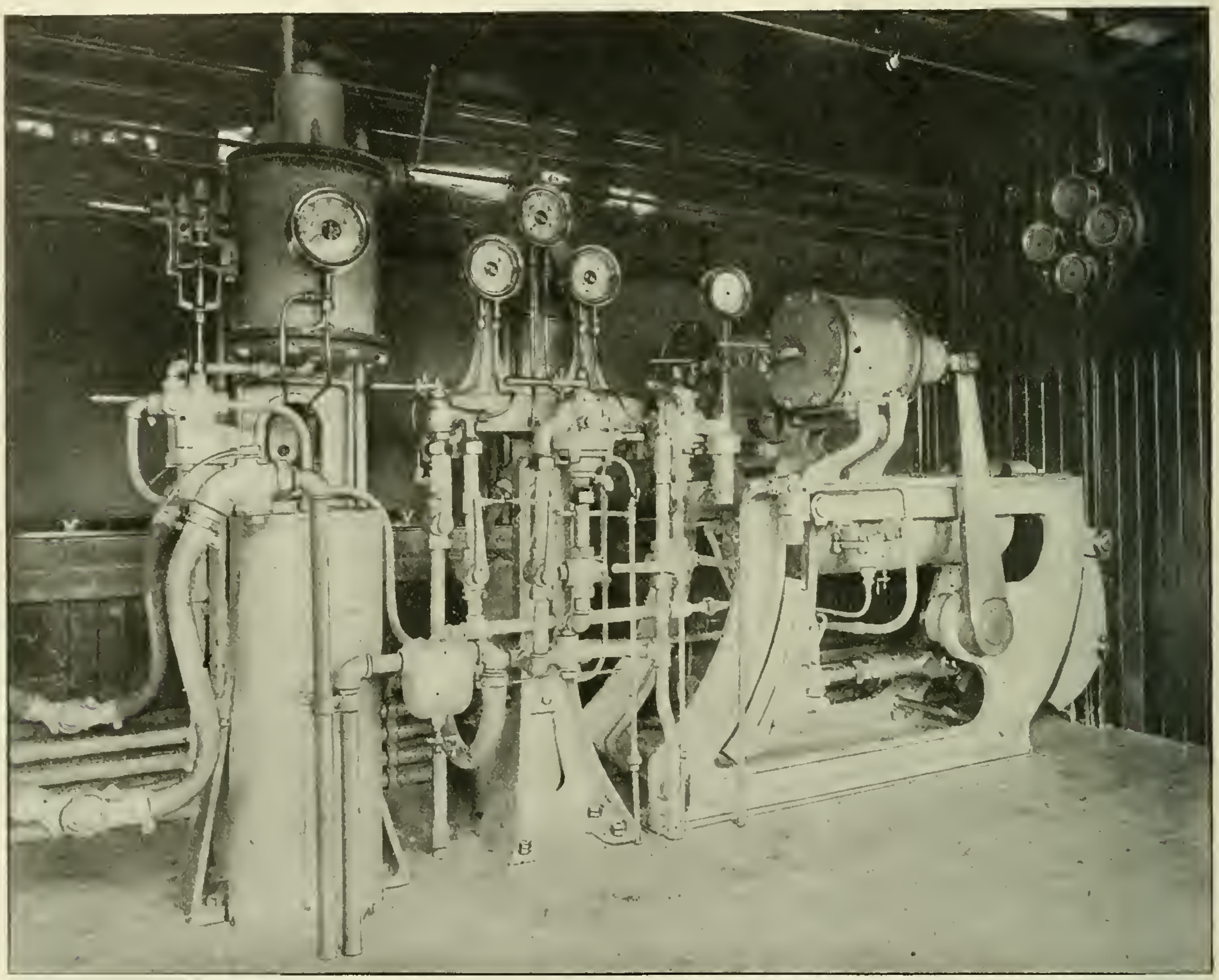
"Why, it's 'cause he's cheap!" he explained. "They won't pay enough to get a good man, and here we have delays and engine failures all charged up to the brakes. S'pose this winter they'll be stickin' all the slid flat wheels on the engines, 'cause everybody knows the engine brakes ain't any good. Wish one of them West'n'house fellers would drop round this way. I'd like to hear what he'd say."

By this time we were well out on the road, and just at this point he blew for the station and started to make the stop. Just as we were about to stop and he had released the brakes (for he handles a train nicely), the kicker said abruptly, "Ever run an engine?"

I admitted that I had. "All right, then, take her awhile," he said, and made room for me to take charge.

As soon as I got the injector at work again, and had settled down for a run to the meeting point, I looked up at the air gage, and to do so had to lean away back and to one side. The kicker broke forth, "Now ain't that a pretty howd'e do to have on a decent road engine on a first class road? Stick the air gage away up there, where no one but the 'prentice boy that put it up knows where it is, and he couldn't find it without a torch. 'N yet they expect a feller to do good braking, drop a train down the hill without exceedin' the speed limit, and be prepared to stop on a tack head at Millville." "How's that?" "Why, the dispatcher generally runs both 74's and one section of 174 up there an' its a saw by, an' them flagmen won't get out a decent distance when your s'posed to have air."

By this time we were pulling into the



AN INTERIOR VIEW OF THE GRAND TRUNK'S NEW AIR-BRAKE INSTRUCTION CAR.
Observe the splendid and original arrangement of driver brake apparatus; also the arrangement of B11, D8 and F6 brake valves, and liberal use of gages.

siding for the "Limited," and conversation lagged for a little. When we got stopped the kicker said, "Why can't that air gage be put in a more convenient place, somewhere where a feller can see it anyway, no matter if they have to take the whole durn cab off to get at it. Now, if it was only turned around a little it would be better than as it is. But say, that's a whole lot better than on some of our engines. Some of 'em have got it layin' down so that when the red hand is at 90 it's pointin' right across at the steam heat regulator. Seems most as if they had a crowd of lunatics to toss a gage up and let it fall and see which way it would come down."

Just then the "Limited" went whizzing by and the fireman remarked "Dad's a wingin' 'em to-night, ain't he?" "Yes," replied the kicker, "but just listen now an' hear him give 'er the emergency at that water crane down there." As he said this, there came a "whish" drifting back through the night air, and John remarked, "There, that's what he calls a good stop."

At that I widened on the throttle a little, for I didn't want to make any adverse comments on Dad's stop. The kicker resumed, "Been tryin' to get 'em to put a shield behind the driver brake cylinders on this engine for two weeks. Burn the packin' leathers out every week, but they seem to think it cheaper to put in new leathers than to put on a shield."

"A shield won't do much good unless you block the cylinder away from it to allow the air to circulate behind the cylinder," I interposed.

"It won't! Why won't it? Don't it keep the heat from strikin' the cylinder?" he asked.

"Yes, and iron is a good conductor of heat. How much would it help matters to make the wall of the cylinder thicker? That's virtually what you do in bolting the cylinder right up against a shield."

"Huh! Hadn't thought of that, but that's so, ain't it? And the cylinder ought to be blocked away so as to let the air circulate back of it. That's all right! Say, what kind of leather is that they use in them cylinders, anyhow?"

"Don't know. What does it look like?" I asked.

"Looks like sole leather," said he.

"Maybe it is,' I replied. "Guess, very likely it's what they call oak tanned leather, ain't it?"

"Naw, machinist calls it oil tanned," said John, in disgust, "but there ain't enough oil in a whole side of it after it's been soaked for a month in an oil tank, to grease a pair of patent leather shoes. Never saw such hard dry stuff."

"Well, that's oak tanned, all right," said I.

"Must be somethin' of that kind, the way it leaks even after they put in a new leather, and after a little while it wouldn't hold gravel. What kind of stuff is oil tanned leather? Like harness leather?"

"No," I explained. "It's about a walnut color, and if it gets warmed up a little it's like a dish rag."

"Is that so? Never see any of that kind down this way. They have to soak these leathers in water, and then form 'em while they are wet. Can't get them into the cylinder any other way. I dropped on to a little scheme the other day. Brown was gettin' his engine ready to go out on 17, an' the brake wouldn't hold, 'n he poured water into the cylinders, an' say, that brake was a hundred per cent. better."

"Yes? But how long would that water stay there?" I asked John. "Well, not very long, that's a fact."

"What sort of shape do you suppose those leathers were in when that water evaporated?" I asked, pushing matters further.

"Dunno. Couldn't be much worse than they were," said John.

"Did you ever have a pair of leather boots get soaked with water? What kind of shape were they in when they got dry?"

John broke into a loud laugh. "Holy smoke!" said he, "that's a corker on Brown. You just saved my leathers young feller, for I intended to soak 'em when I got in. Say they won't last long that way, will they?"

"No," I replied, "you had better use oil."

That seemed to gratify John, for he went over on the left side and subsided for awhile, and I saw him grinning to himself. We were getting pretty near the terminal by this time, so at the next station I bade him good night and went back in the train. As I left, he said, "Say, come around the roundhouse in the morning and see our fellows, will you? And if you're ever down this way again come and ride with me." I thanked him for his invitation and left him.

I became better acquainted with John later on. He always had a kick coming, and so kept up his reputation. But he knew what was right, and generally got it.

BOB MICHAELS.

Atlanta, Ga.

EXTERIOR VIEW OF THE GRAND TRUNK'S NEW AIR-BRAKE INSTRUCTION CAR.

In Explanation.

Editors:

While I greatly appreciate the courtesy extended me by the publication in your last issue of a personal notice in relation to the recent change in my business affairs, it strikes me at first glance, that, by the manner in which it was worded, you may, unintentionally, have conveyed the idea to many of my friends that in going into the patent-law business I am entering a field entirely new and unfamiliar to me, whereas, the fact is that in addition to my air brake work, I have for some time had entire charge of all the patent work of both the Crane Company and the Crane Elevator Company, of this city, and while I have just recently opened an office of my own as a regular attorney, I still retain all the patent soliciting work of the two concerns mentioned.

Trusting that you will grant me space for the correction of any misapprehension that may have arisen in the manner referred to, I remain, with best wishes,

PAUL SYNNESTVEDT.

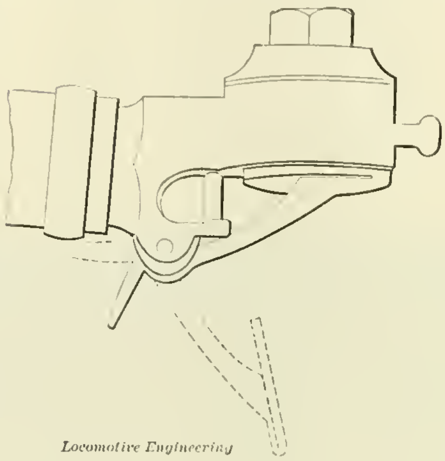
Chicago, Ill.

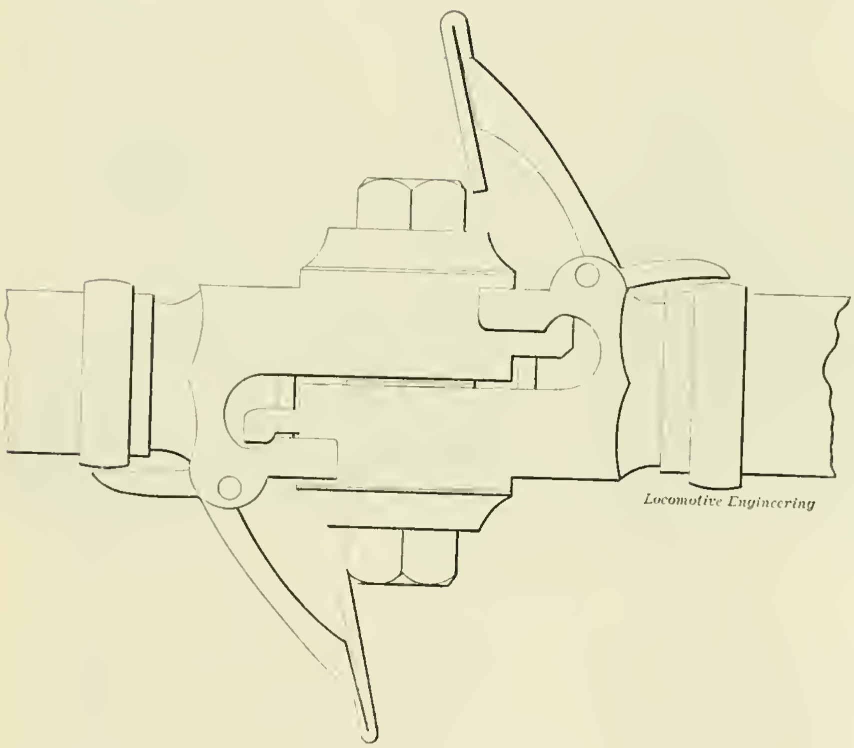
A Dust Guard.

Editors:

I herewith enclose you the tracings of an air brake dust guard, which I think is altogether practical, and which I have had in mind about three months.

The device is simple, and needs little explanation. The introduction of the spring makes it sure to work, and also allows of a discharge of air from the brake





A DUST GUARD FOR AIR BRAKE HOSE.

or signal pipe, whenever angle cock is opened, or train breaks in two.

GEO. SHUART,
Fireman K. C., F. S. & M. Ry.

Joplin, Mo.

[The device no doubt contains merit, but we are not sure that this is the first of its kind.—Ed.]

Emergency from a Gradual Reduction.

Editors:

The three main troubles which cause brakes to fly into quick action, when making a gradual service reduction of train line pressure, are a weak or broken graduating spring, a broken graduating pin and sticky triple.

The first trouble mentioned will be noticed only on a short train; but the latter two will cause quick action regardless of the length of train.

If the train line pressure is reduced faster than the auxiliary pressure can get to the brake cylinder through the service port of the slide-valve, quick action ensues if the graduating spring is weak or broken, as there is nothing to stop the piston from moving full stroke. This case can happen only on a short train, as, on a long one, the train line volume is so much greater that a certain reduction requires a greater length of time proportionate to the train length. The limit of the number of cars that will be affected by a broken graduating spring is from five to seven. With a train of over seven cars all graduating springs could be removed without experiencing any ill effects.

If the graduating pin is broken or the graduating valve disconnected it can not be moved from its seat. With the first five-pound reduction the triple will assume service position, but the brake will not set on that car, as the service port is blocked. Just as soon as the reduction is sufficient to allow auxiliary pressure to overcome the tension of the graduating spring, this car goes into quick action, and the same result is produced on the whole train.

With a sticky triple there is no movement whatever until sufficient train line reduction has been made to allow auxiliary pressure to break the triple piston and slide-valve free from the gum and corrosion. The quick movement of the piston compresses the graduating spring and we have the same result as with a broken graduating pin or spring.

The general idea on the road is that these emergency applications are caused by a broken graduating spring or pin, but instead of their being the rule they are rather the exception, as the chance is very small for the breaking of these parts. In most cases, if closely examined, it will be found that the cleaning and oiling of the triple will do away with the trouble.

If quick action occurs on a long train with a gradual reduction, the best way to find the imperfect triple is to make a light reduction and cut out the triple on the car where the brake does not set. If it cannot be found in this way, turn the angle cocks in the middle of the train and see which half contains the seat of trouble. Then cut the cars in from the middle, five at a time, if on the last half; and cut out, five at a time, if on the first half. We can thus readily locate the car to be cut out.

It costs some money to keep triples properly cleaned and oiled, but triples in good condition do not throw a train into quick action, shifting and damaging freight where the train is only partially equipped with air brakes.

R. H. BLACKALL,
D. & H. C. Co.

Oneonta, N. Y.

Frank M. Ashley, Hawthorne, N. J., has been granted a patent on a new air-brake system.

The plate of the Traveling Engineers' Convention, shown last month, has been printed on paper suitable for framing. Price 10 cents.

The proceedings of the Traveling Engineers' Convention, held in Chicago in September, are nearly ready, and can be obtained in this office; price 75 cents in paper cover, and $1 in leather. The proceedings are exceedingly interesting, and ought to be read by every train man. To motive-power men the report of the Traveling Engineers' Convention is far more valuable and interesting than the reports of any other conventions.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(107) J. C. K., New York, asks:

Is it possible for piston and slide valve in a plain triple to jar down while running. A.—No.

(108) W. R. M., Bangor, Me., asks:

Should water be used on a hot pump to cool it down? A.—No. So doing is liable to damage the pump by cooling one part faster than another.

(109) J. C. K., New York, asks:

Why is the hole, filled by a plug, necessary in brake-cylinder end of freight auxiliary? A.—It is to facilitate the molder's work in casting the cylinder, after which it is plugged up.

(110) B. W. S., Princeton, Ind., writes:

Is there any reason, other conditions being equal, why hot air cannot be carried through a pipe as far as steam, the supply in each case to be continuous? A.—At certain high pressures and very slow flow, we think, there should be no appreciable difference.

(111) W. R. M., Bangor, Me., asks:

Does it pay to take off the top head in case the pump cannot be started? A.—Only in exceptional cases, and provided that it is not going to consume too much time. Generally, it would not pay for the delay. Again, the facilities for doing the work are limited, as is the time.

(112) C. B. B., Jersey City, N. J., asks:

Is it possible, while running along, for driver brake or tender brake to apply, on account of piston in triple being jolted down into braking position? A friend of mine says that it can happen, and claims good authority. A.—No, unless the train pipe pressure is reduced. The pressure on the slide valve is many times greater than is required to hold the parts in release position.

(113) J. O., Jersey City, N. J., writes:

How many cars are required to notice difference in closing of preliminary and of train line exhausts? I have from two to five cars and can notice no difference in time of closing, both shutting off instantly when valve is placed on lap. A.—About 5 or 6, and sometimes even less. It depends somewhat upon the condition of brake valve and degree of freedom with which the equalizing piston works.

(114) C. B. B. Jersey City, N. J., asks:

If in the 9½-inch pump steam should leak by the small piston 79, and packing rings into the chamber behind, would it not prevent pump from operating, or is there some provision made for escape of such leakage? A.—There is a suitable port connecting this chamber to the exhaust port, to allow leakage to escape. This port is similar in function to those in the reversing bush of the 8-inch pump. See reply to B. J. M., this number.

(115) J. O., Jersey City, N. J., writes:

In Forney's catechism, chapter on air brakes, it is said the greatest braking force that can be applied to the drivers is 12,000 pounds to each. Is not this incorrect? A.—1. The author means that the braking power given is the greatest that can be obtained from the cylinder and leverage about which he is writing. 2.—Is there any particular figure set down as a limit beyond which danger of loosening tires would prevent us from going? A.—2. No.

(116) J. O., Jersey City, N. J., writes:

In your article on "Doctor Standard," in October number, it is stated that in second Burlington test "Quick Action" nearly lost on account of the shock at rear end, which his valve gave. What was the difference between the valve then used and that now in use? As I understand your description, it acted the same as present form. A.—The principle of the two valves is the same. The form of the valves, however, is somewhat different, owing to the improved arrangement of the inner parts and perfection of minute details.

(117) J. A. S., Port Jervis, N. Y., writes:

The Master Car Builders say auxiliary must charge in 55 seconds. "Progressive Questions" (226) says it cannot be done in less than 1¼ minutes, and instructors tell us it takes 2½ to 3 minutes. How is this? A.—The triples generally used in instruction plants are of the earlier quick action form, in which the feed grooves were made smaller, and, therefore, frequently require 2 to 2½ minutes to charge from 0 to 70 pounds. Hence the instructor's figures. Experience has brought about the M. C. B. figures, and later triples conform to them.

(118) A. H. L., Boston, Mass., writes:

Our air-brake instructor has ordered all pipes taken out of the elbow at the train-pipe exhaust of the brake valve. He objects to the pipe, but don't say why. Please explain. When the pipe is out, dust blows all over cab every time brake is set. A.—Your instructor objects on good grounds. The engineer should hear the exhaust each time brake is set. The length of exhaust indicates length of train, and is a telltale if any angle cocks are accidentally or maliciously closed. Turn the elbow around about 90 degrees, and it won't blow dust.

(119) R. M., Jersey City Heights, N. J., asks:

1. Does the reversing piston strike on bottom of its bushing each time it ends its downward stroke? A.—1. No. See answer to "B. J. M.," in this number, regarding lead in air pumps. 2. Why do valves having too much seat bearing, or bearing being at too acute an angle, cause the valve to stick? A.—2. When seats are wide there is a greater surface exposed for gum to deposit and cause the valve to stick. Seats having too acute angle are likewise objectionable. In addition, they more nearly approach the shape of a sharp wedge, with corresponding tendency to stick.

(120) C. L., Frackville, Pa., asks:

What should be the size of auxiliary reservoirs for 6, 8, 10, 12 and 14-inch brake cylinders, respectively, and also where there are two brake cylinders to one auxiliary reservoir? A.—14-inch cylinders should have 16 x 33 auxiliary reservoirs; 12-inch cylinders, 14 x 33; 10-inch cylinders, 12 x 33; 8-inch cylinders, 10 x 24. Freight car cylinders, 8 inches in diameter with 12-inch stroke, have auxiliary reservoirs 11 x 21½; 8-inch cylinders, 8-inch stroke, 11 x 15; 6-inch cylinders, 8-inch stroke 9x18; and on cars having two 6-inch brake cylinders, 8-inch stroke, 11 x 21 auxiliaries are used. These measurements are outside ones.

(121) R. M., Jersey City Heights, N. J., writes:

I have been studying the last issue of the Air-Brake Association book, and am puzzled about a pump blowing. How are you to know, after disconnecting exhaust pipe, whether pump is blowing or not; that is, how are you to tell difference between the regular exhaust of steam and live steam blowing through some part? A.—Pump up to that pressure which will, with full throttle, cause the pump to "labor" or run slow. The exhaust will be distinguished by its sharp and forcible discharge at the ends of the stroke. The steam lost by leakage will escape between the exhausts more regularly and less forcibly.

(122) J. A. S., Port Jervis, N. Y., writes:

Was there any change required in the three way cock in order that it could be used with either straight or automatic air? This was before my time, and I know nothing about it. A.—The three way cock wasthe first form of brake used, and made its appearance with the introduction of the straight air brake. When the plain automatic brake supplanted straight air, the three way cock was retained and became a part of the automatic system. The use of automatic brakes on long trains demanded a brake valve which would not release head brakes. The equalizing feature was conceived and developed. See answer to B. W. on this subject in this number.

(123) B. J. M., Chattanooga, Tenn., writes:

What are the four small holes for in a straight line in the reversing piston bushing in the air pump? When the reversing piston is down, the holes lie between the packing rings. A.—When the reversing piston is in its upper position, these ports admit exhaust steam to the underside of piston. When the piston is driven downward, the exhaust steam is expelled through these ports until the reversing piston covers them, then the steam remaining trapped is used as a cushion to prevent the piston from striking the bottom of reversing cylinder. This is simply a cushion, and cannot be called "lead."

(124) W. G., Baltimore, Md., asks:

1. With the new high-speed brake, are there any changes to be made in the foundation brake gear; that is, in the change of levers? A.—1. Not if the levers are as heavy as the M. C. B. Association recommends. There is no change in the proportion of the levers. 2. If an engine is to run a high-speed braked train in both directions, will not the ordinary equipment do, by increasing the train-pipe pressure, and adding the automatic reducing valve to the cylinder? A.—2. Yes. 3. With the train-pipe pressure at 110 pounds for the high-speed brake, what should the main-reservoir pressure be? A.—3. About 120 or 125, or whatever the local conditions might require.

(125) J. A. S., Port Jervis, N. Y., writes:

It is stated in "Progressive Questions and Answers" that when fully charged, the train line and auxiliary reservoirs are "comparatively" equal. If I am not mistaken, the "Locomotive Engineering" chart shows the auxiliary and small reservoirs as unequal with the train pipe. A.—We do not know to what part of the questions and answers you refer, or in what sense the quotation is used, but would say that when train line and auxiliary reservoir are fully charged, they are equal, and the equalizing reservoir is also equal in pressure to them. In other words, all three are equal when fully charged, and are different in pressure only during time of application or in process of charging.

(126) B. W. S., Princeton, Ind., writes:

Suppose we take two trains, equipped in all other respects equal, except that one is to be operated with a pressure of five atmospheres, and the other with two atmospheres, and that it is required to reduce the pressure in each train pipe, say, 12 pounds. Will the reduction in the high-pressure pipe be accomplished in less time than that in the low-pressure pipe? If so, why? A.—Yes; because the greater pressure has a greater force behind it to force it out. For example, pump up to 70 pounds train-line pressure, and with a watch time the successive 10-pound reductions, from 70 to 0 pounds made in service position. The reduction from 70 to 60 will require less time than that from 30 to 20 pounds.

(127) B. W., Port Jervis, N. Y., writes:

Why is the bottom part of the signal valve underneath the cab larger than the top part? I mean, why is the space larger beneath the rubber diaphragm than above? A.—1. The bottom chamber of the present form of signal valve serves as a reservoir for pressure to produce the blast of the whistle. The function of this bottom chamber in the present valve is practically the same as the reservoir on the old type. 2. Why is this better than the old signal with the auxiliary reservoir? A.—2. It is simpler, and a greater number of successive blasts can be obtained than with the old form.. Many troubles credited to the signal valve really belong to, and can be frequently traced to the clogged condition of the car discharge valve.

(128) B. J. M., Chattanooga, Tenn., writes:

Has the air-pump got lead? One of our men says he will argue that it has, or that it has not. Please decide. A.—By "lead" is meant the arrangement of the valve motion whereby the exhaust from the cylinders of an engine is closed and live steam is admitted before the piston completes its stroke. The object is to furnish a cushion for the piston. In the air-pump there is no provision of this kind made, as the cushion for the piston is furnished by the pressure in the air cylinder and main reservoir. If the pump is run fast when pressure is low, the piston will strike the head. It is for this reason, principally, that it is recommended to run the pump slowly until about 40 or 50 pounds has been accumulated in the main reservoir.

(129) J. W. A., Brooklyn, N. Y., writes:

I have a D 8 brake valve on my engine. For the last few days the brakes on engine and tender have been continually applying and releasing. They whistle off at the triple exhaust. Air leaks out of the preliminary exhaust at the brake valve. When the engine is coupled to a car or two the brakes on cars are all right, but on engine and tender they keep applying and releasing the same as with the lone engine. A.—The leakage groove in your tender brake cylinder is probably clogged up, and the packing in your driver brake is tight, making these brakes susceptible to small train line leaks. The grooves in the cars are probably clear. Perhaps a gummy excess pressure valve and non-sensitive governor help complicate matters. Examine these parts. Also have the rotary valve reseated.

(130) W. G., Baltimore, Md., asks:

If an air-brake train broke in two, and the engine drivers locked and slid, what would you do to get them revolving? A.—In the first place, the assumption that drivers will slide when a train breaks in two is entirely unfounded. The driver brake tests made at Nashville on the N. C. & St. L. Ry. in 1895, proved that it is an exceedingly difficult, and almost impossible matter, providing the engine is properly braked, to lock the drivers when the train breaks in two, unless the engine is reversed. However, should bad rail or other cause make the event possible, it would be useless to try to unlock the wheels. Steam might be used, but a brake that is sufficiently powerful to lock the drivers will resist such efforts. This attempt would be analogous to trying to start an engine with the driver brake applied.

(131) W. R. M., Bangor, Me., asks:

What should an engineer do when the air pump, 8-inch, stops? A.—First close the air-pump throttle, and a few minutes later open it quickly. If this does not start the pump, tap lightly, with a soft hammer or block of wood, on the *outside* cap nut. If either of these remedies starts it, feed the lubricator faster; if not, remove the *outside* cap nut and examine the reversing piston. If one ring is broken, carefully remove all the pieces and blow the ports out, then oil well, and when replaced it will generally run all right until the terminal is reached. Cases have been known where candle wicking was used successfully for packing this piston, in the event of both rings being broken. Where only one ring is in service, or where both are gone, a more liberal supply of oil is required than if both were in place.

(132) G. C. L., Lowell, Mass., asks:

With the quick action triple valve could the air in cylinder be let out by opening bleeder on reservoir, after an emergency application (train pipe empty), or would graduating spring close the graduating valve before pressure was all gone. A.—The air would pass out from the brake cylinder through the auxiliary reservoir and bleeder until the graduating spring tension was stronger than auxiliary pressure, then the slide valve would move up and blank the cylinder port. By this time the brake cylinder release spring would have moved the piston considerably homeward, possibly far enough to uncover one end of the leakage groove, and the cylinder air would escape through it. Again, there is a chance of the slide valve tipping or leaking, which will allow the remaining pressure in the brake cylinder to escape.

(133) E. G. R., Mt. Savage, Md., asks:

Why does the 8-inch pump always stick on the bottom of stroke when out of order? Some say it is the weight of the piston. If this is so, why does it not move up when steam is turned on? A.—The piston does not always stick at the bottom end of stroke. There are causes which make it stick at the top end as well. Your trouble is probably caused by a loose or worn reversing valve plate, or loose or broken nut on end of piston in air cylinder. These are the more common causes. We would strongly urge you to procure a copy of the Air-Brake Men's Nashville Proceedings. The paper on "Air Pumps; Their Troubles and Treatment, and Tools for Making Repairs" is the best treatise on air pumps ever written, and should be in the hands of each repairman and others interested in air brakes. Price 50 cents, for sale in this office.

(134) J. C. K., New York, writes:

Why does not the equalizing piston lift its full distance in reductions where chamber D has finished reducing, before the train line has finished? In cases where it takes train line longer to reduce than chamber D, train line must be stronger at time of finish of chamber D exhaust than pressure in chamber D. That is clear, and that being the case, why will not the train-line pressure push that piston all the way up, and escape quicker in that way? A.—With about ten cars the equalizing piston travels its full stroke. On a less number it stops short of that. Just where, is somewhat uncertain, and dependent upon the condition of the piston. A great many pistons require a pound or two reduction before they will lift, and of course would resist with the same amount of friction, being pushed to the full stroke. This would account for the difference in pressures in chamber D and train pipe, as above mentioned.

(135) E. G. R., Mt. Savage, Md., asks:

1. Why does the 8-inch pump blow on the up stroke and not on the down stroke? A.—1. If the blow is on the up stroke and not on the down stroke, it is in either or all of the following places: the reversing slide valve rod 17 in bush 19, rod 17 in cap 20, past packing rings in reversing piston 23, or perhaps slide valve 16. As will be seen, all these parts are in communication with the exhaust on the up stroke, and consequently manifest themselves on the up stroke. On the down stroke the first two mentioned, and the most common, blow into the live steam on top of main piston 10. Blows on both up and down strokes are as follows: slide valve 16, main valve 7, and main piston packing rings 12. 2. Why are so many packing rings turned eccentric with the bore? A.—2. When sawed, after turning, rings so made do not spring as wide apart at the ends, and consequently fit the cylinder better in which they work.

(136) B. W., Port Jervis, N. J., writes:

Was there ever an equalizing apparatus used on the Westinghouse brakes that was separate from the engineer's valve? I have an 1887 catalog showing such a device used in connection with the old brass engineer's valve that was in use before the equalizing engineer's valve. I never saw one of these separate equalizing parts, and never met anyone who did. A.—The use of automatic brakes on freight trains soon made manifest the necessity for an equalizing feature of some kind to prevent the release of head brakes. The prior use of brakes on passenger trains did not demand this feature, as the trains then were short and the three way cock was sufficient, as only plain triples were used. But long freight trains required it. The brass valve, or B11, was the first attempt, but was unsatisfactory on account of not being automatic. The present equalizing piston principle was conceived, and was embodied in a separate valve placed in the train pipe under the tender. So satisfactory was its performance there that it was soon afterwards embodied in the brake valve proper.

(137) J. C. K., New York, writes:

In answer to an argument made by Paul Synnestvedt, in the February and March (1896) numbers of "Locomotive Engineering," it is stated that quick-action triples could not be used on tenders unless the graduating springs were made stronger. It would seem, however, that they are now being used on tenders, with high speed equipment, without any change of spring. Would you kindly explain, if any changes were made to accomplish this result; also, what the unworthy practices were, which, in article on page 185, February (1896) number, it is said, using heavier springs would be catering to? A.—The argument was against the general use of quick-action triples on tenders. The high-speed brake, at that, used a quick-action triple on the tender, and we should have so stated. There has been no change made to adapt it to this class of service. The wrong practice referred to was the undue use of the emergency position.

(138) R. M., Jersey City Heights, N. J., writes:

Is there any way an engineer can tell, when he has, say, five cars, about how high his auxiliaries are charged, compared with train-line pressure as shown by the gage, except by waiting till feed valve closes at 70 pounds? Some engineers claim that on a train of any length the charging of the auxiliaries keeps up with the rise in pressure, as shown by the gage as it starts towards 70, after they cut into the train. A.—If the train pipe, auxiliaries and main reservoir are all empty of pressure, and the pump be started, all will charge alike, as all are connected. The black pointer will indicate the pressure in train pipe and auxiliaries, and the red pointer, coinciding with the black one, will register main reservoir pressure. But if the train pipe and auxiliaries on the cars be empty, and the main reservoir on the engine be charged when the coupling is made, the black hand will indicate train pipe pressure only. By lapping the valve and waiting until the black pointer stops dropping back, the point at which it stops shows that train pipe and auxiliary reservoir pressures have equalized at that figure.

(139) J. A. S., Port Jervis, N. J., writes:

It is said that a loose stem in the signal valve causes whistle to blow twice. How do you explain its blowing twice? I suppose of course it must seat and then lift up again, which would seem to indicate that the pressure escapes faster off the bottom than off the top; is this the case? A.—Perhaps as good an explanation as any is as follows: In pulling the cord, the reduction of pressure at the car discharge valve allows the greater and undisturbed pressure in the bottom of the signal valve to lift the diaphragm and stem against the reduced pressure on top of diaphragm, and, until an equilibrium is reached, pass out through the whistle, making the blast. The pressure reducing valve opens and sends its recharge to the signal vavle closely on the heels of the reduction then on its way to the signal valve. This recharge should hold down the diaphragm and allow the under chamber to feed up past the stem. If the stem is loose, however, the recharge reaches the under chamber almost as soon as the top, and, following so closely on the heels of the reduction, finds the diaphragm in a state of vibration still, and easily forces it upward. Dropping the stem down about a scant 1-32 inch in the bush, thus charging the under chamber more slowly, will cure this trouble.

(140) J. H. M., Savage, W. Va., writes:

On one of our locomotives equipped with the Leach pneumatic sanding apparatus, the tender brake sets every time the sander is used. The engine has a D-8 brake valve. The air supply for the sanding apparatus is taken from the main reservoir pressure. The connection is made in the gage pipe which carries main reservoir air from the brake valve to the red hand. The engine is used on a short branch road, and scarcely ever haul any air cars. What is the cause of the trouble? A.—Some sanders have been connected to the gage pipe leading from the brake valve to the black hand, or to the equalizing reservoir pipe, which contains the same pressure, and, in consequence, each time the sander is used the pressure on top of the equalizing piston is reduced, thereby causing the brakes to set. With the connection as you describe, the sander is probably using more pressure from the main reservoir than the pump is putting in, and pressure from the train pipe returns to the main reservoir, making the reduction which sets the brake. This could happen if brake valve handle were left in full release position, as it is liable to be, under the conditions given. As nothing is said about the driver brake setting, we assume the tender brake alone applies. This could be accounted for by the leather packing in the driver brake cylinders not being in as good condition as that in the tender brake cylinder, or perhaps the leakage groove in the tender brake cylinder is clogged up.

For the first time since the Argentine Republic began to do railroad work, the government of that country has invited bids from citizens of the United States. They want a new central station in Buenos Ayres, not to cost more than $4,000,000 (about $2,000,000 of our money). This ought to build something of a station.

EQUIPMENT NOTES.

(*Continued from page 833.*)

The Baldwin Locomotive Works are engaged on an order for two six-wheel connected engines for the Atlantic Coast Line.

One six-wheel connected engine is being built for the Occidental Railroad of Guatemala at the Baldwin Locomotive Works.

The Terminal Railroad Company of St. Louis are having two six-wheel connected engines built at the Baldwin Locomotive Works.

The Oahu Railway and Land Company are having one six-wheel connected engine built at the Baldwin Locomotive Works.

The New York Central & Hudson River Railroad are having ten standard engines built at the Schenectady Locomotive Works.

The Astoria & Columbia River Railway are having one four-wheel connected engine built at the Schenectady Locomotive Works.

Two six-wheel connected engines are being built at the Baldwin Locomotive Work for the Detroit & Lima Northern Railroad.

The Richmond Locomotive Works are engaged on five eight-wheel connected engines for the South Carolina & Georgia Railroad.

The Lake Shore & Michigan Southern Railroad are having twenty six-wheel connected engines built at the Brooks Locomotive Works.

The Chicago, Milwaukee & St. Paul Railway are having twelve six-wheel connected engines built at the Baldwin Locomotive Works.

The Lehigh Coal & Navigation Company are having several eight-wheel connected engines built at the Baldwin Locomotive Works.

Five six-wheel connected engines are under construction at the Schenectady Locomotive Works for the Chicago & Northwestern Railway.

The Chicago, Milwaukee & St. Paul Railway are having five six-wheel connected engines built at the Schenectady Locomotive Works.

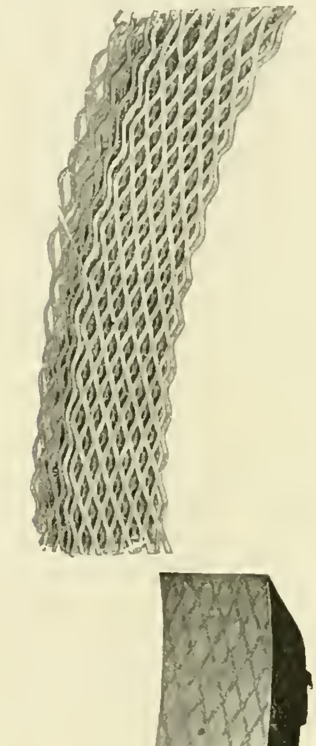
The Louisville, Henderson & St. Louis Railroad are having two six-wheel connected engines built at the Pittsburg Locomotive Works.

Three six-wheel connected engines are under construction at the Baldwin Locomotive Works for the Houston, East & West Texas Railway.

The B. & O. Railroad is having built ten express cars for the use of the United States Express Company on the B. & O. lines. These cars are to be 60 feet in length, of extra strength, and so arranged that they can be used for the transportation of fine horses. They will be fitted up with removable stalls, and when not used for horses, will be placed in regular service.

The Diamond S Brake Shoe.

In 1889 the Master Car Builders' Association appointed a committee to conduct a series of laboratory tests to ascertain what metal was best adapted for the construction of brake shoes. The requirements of a suitable metal called for sufficient friction for holding power, durability, uniformity, strength to insure safety and mild and uniform effect on tire. While testing a miniature Congdon shoe one of the committee observed that an accumulation of cast iron granules was



DIAMOND S BRAKE SHOE.

formed on the upper edge of such of the wrought iron inserts, causing the surrounding iron to heat to redness, until finally the granules passed over the surface of the wrought iron and the heat subsided until another accumulation of cast iron granules had been caused. This convinced the observer that the weakness of the Congdon shoe was that the wrought iron barriers were not sufficiently subdivided.

This set him to scheming out something better, and after various experiments he hit upon the plan of forming into the shape of the brake shoe a bundle of meshes cut from mild steel, into which the cast iron is poured, thus forming a combination steel and cast iron shoe. The form of the meshes ready for placing in the shoe mold is shown in figure 1. The shoe as it appears while in service is shown in figure 2.

Exhaustive service tests with this shoe prove that it possesses in an eminent degree all the good qualities that have been lacking in most of the brake shoes hitherto put upon the market. It has excellent holding power, is so durable that it wears out a great many cast iron shoes doing equal service, is easy on steel tires, and is so strong that it can be worn down to a mere shell without danger of breakage. These sum up all the merits of a good brake shoe that we are familiar with. It has been put upon the market by the Sargent Company, Chicago, Ill.

The most handsome illustrated catalog that we have examined for a long time has recently been published by the Crosby Steam Gage and Valve Company, of Boston. It contains beautiful illustrations of the great variety of gages, valves and other steam appliances made by the company. In the front, there is a very artistic page, formed from the photographs of the medals received by the company at the various expositions where their goods were shown. Engravings showing their marble gage tablet and sets of various instruments are exceedingly striking. Excellent illustrations of the Crosby indicator are given and of the various apparatuses in connection with its use. Besides the illustrations, the volume contains a great deal of useful information concerning steam, and finishes with reliable tables giving the circumference and area of circles.

Just as we go to press we receive the particulars of a fearful accident which happened on the New York Central on the morning of October 24th. By the slipping of an embankment an express train was precipitated into the Hudson River. About twenty persons lost their lives by drowning. Several of our personal friends were among the unfortunates. Another had a remarkably close escape. That was Mr. F. H. Stillman, of the firm of Watson & Stillman. He was in the sleeper that went into the water, but being awake when the crash came, had the presence of mind to pull up the window and jump into the water. He succeeded in swimming ashore.

The "Street Railway Journal," of New York, did itself proud by issuing a Niagara Falls Convention number having 134 pages of reading and illustrations and a total of 362 pages, besides the cover. An idea of its size can be gained by thinking that it weighs over four pounds.

Four magnificently equipped trains have just been built at the Wagner Palace Car Works, in Buffalo. They consist of thirty-one palace cars, comprising dining, buffet, library, regular and compartment sleepers. The cars are finished in olive green and scroll gold, a new design recently adopted by the Wagner shops. The state rooms are finished in white and gold in some of the cars, and in others finished in natural wood. The upholsterings are of heavy silks and tapestries of great richness. These moving palaces, illuminated by electricity, will run on the twenty-four hour service from Boston and New York to Chicago.

"The Gold Fields of Surinam" is the name of a new illustrated paper, the first number of which has been received. It is a very handsome production, with a great many fine engravings, printed on a fine quality of coated paper. Surinam is in Dutch Guiana, in South America, but the paper is published in Boston. Nearly all the scenes depicted are in Dutch Guiana, and they are very interesting. The intention is to publish a number when enough copy is prepared to make up the paper. It is sold for 10 cents a copy.

The Great Northern Railway has opened up four new extensions of branches this season, to wit: Thirty-four miles from Halstad to Crookston, twenty-eight miles from Hope to Aneta, sixteen miles from Cavalier to Walhalla and fourteen miles from Langdon to Hannah. The first named line is in Minnesota, and the other three in the famous wheat belt of North Dakota. The Great Northern has also equipped its passenger coaches with wide or flush vestibules.

It is announced that the Pennsylvania Railroad will spend a large sum in double-tracking the Camden & Atlantic road from Berlin to Atlantic City, in elevating the tracks from the drawbridge into the city, a distance of two miles, and in erecting a grand terminal station of stone, brick and iron. The improvements, especially the double-tracking, will shortly be begun.

It is announced that the Japanese Government has adopted the 60-pound standard Pennsylvania Railroad rail for the extension of the imperial road.

It is reported that a recent accident on a Brazilian railway has been attributed to some genius who greased the rails to help the train up a steep grade.

The Japanese Government has contracted with the Illinois Steel Company for 26,000 tons of 70-pound steel rails and fastenings.

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(79) F. V. B., Galston, Pa., writes:

There has been an argument here among the men with reference to two time-card rules; one is, "You will govern yourself accordingly," and the other is, "You will be governed accordingly." What is the difference, if any? A.—We fail to see an opening for discussion in the case, since both clauses plainly indicate that the rules are for the government of the employé in accordance with the provisions of the former.

(80) J. P., Marshalltown, O., asks:

What is the trouble with a Monitor injector that does not prime good, and when working, breaks very easy, when just cleaned out and apparently in good condition? A.—The reasons for failure of an injector to work properly are many, among which are: wet steam, leaky joints and too little volume of water to abstract the heat of the steam. With high boiler pressures the volume of water must be greater than with low, in order to allow the water to condense the steam. An adjustable tube or one designed for the pressures used, will cause the injector to work as it should. See answer 73 in the September, 1896, number.

(81) W. W. L., Bigelow, Mo., writes:

Where both eccentrics and blades are slipped at the same time, please give me a quick and accurate way of setting them. A.—There are no short-cuts for a situation of this character, which resolves itself simply to a case of "valve setting," since the eccentric rods, by changing their length, have destroyed the equality of valve travel, and the shifted eccentrics have produced a like result for the angular advance. The "accurate" way to handle the problem, then, will plainly be to bring the eccentric rods to such a length as will cause the valve to travel equally over the steam ports, and then move the eccentrics on the axle to get the required amount of lead. The "quick" part of the operation depends entirely on the dexterity of the operator.

(82) D. E., Grand Rapids, Mich., asks:

Will you kindly inform me as to the advantages of the Belpaire fire-box? It has always seemed to me that boilers with this form of fire-box were expensive to construct and maintain, as I frequently see them leaking around the corners where the fire-box joins the shell. A.—Several advantages are claimed for the Belpaire fire-box, among which are an increased steam space, a better system of staying than with radial stay-bolts or crown bars, and also furnishing a readier means of washing out of crown sheet. Leaks at the junction of fire-box and waist are not an unusual occurrence in this type of boiler, and the reason for the weakness is the inequality of the strains at the point where the circular sheet joins the rectangular section.

(83) G. C. C., Lowell, Mass., writes:

Please tell me what was the matter with a Seibert triple sight feed lubricator that was filled and run 75 miles, after which the feeds were closed and the steam and water valves left open as usual. The engine was then put in the house and remained 36 hours, the steam pressure going down to nothing for a few hours of that time. Engine was taken out and no oil was found in the lubricator, but the latter was full of water. After filling the lubricator it worked all right again. Where did the oil go? A.—The oil went into the boiler which, as it cooled off, condensed the steam and formed a vacuum, lifting the oil from the cup up through the water valve into the condenser and through the steam valve to the boiler. If the water valve as well as the feed valves had been closed, the oil could not have escaped from the lubricator. The water found in the cup was water of condensation from the boiler after the engine was fired up.

(84) J. B., Peoria, Ill., asks:

Can you say if Dixon's pure flake graphite mixed with tallow, will feed in a Nathan lubricator, and if the same graphite finely pulverized is as good for the purpose as the flake; the pulverized is the only kind I can get here. Is there any danger of the graphite stopping up the lubricator or oil pipes? A.—A graphite and tallow compound will not feed satisfactorily in a sight feed lubricator. The pulverized graphite is equal to the flake in point of quality. Dixon's graphites are the best, and the fact that a lubricator will clog by its use does not detract from the value of graphite as a lubricant. The better way to use graphite in the cylinders is to introduce it in the oil delivery pipes at a convenient point between the lubricator and cylinders, by means of hand oilers, making an application of the graphite at least once each trip, and using the lubricator in the interim, thus making the graphite an accessory to, but independent of the lubricator.

(85) R. R. K., Rich Hills, Mo., writes:

I find if I place a lead pencil in the center of the main crank pin and move the engine, the pencil will make a mark in a series of curves, which convinces me that the crosshead never travels backward in the guides unless the engine slips or is backing up. Am I correct? A.—The accuracy of your deductions is unquestionable from one point of view, but from another the same cannot be said, simply because the case is one of relative motion. With reference to the engine, the crosshead travels backward on its return stroke. Referred to the rail, the motion of the crosshead is never backward, as can easily be proved by assuming a driving wheel to be any diameter—say, 6 feet—and let the pin be supposed to travel 2 feet from the front to the back center, as that is the stroke that introduces the question of backward movement. The wheel will have a circumference of 18.84 feet, and while the crosshead is traveling 2 feet—the length of its return stroke—the wheel will make one-half a revolution ahead, which is equal to one-half its circumference, or 9.42 feet, showing that, with reference to the rail, the crosshead has had a motion of translation ahead far in excess of its stroke motion backward.

(86) J. G. B., Detroit, Mich., writes:

I would like to know what causes an 8-inch driving axle to break—that is, what are the forces to rupture it, and what are the fiber stresses in such an axle on an engine with cylinders 19 x 24 inches, having 180 pounds boiler pressure? A.—An investigation of the failure of driving axles shows that breakage usually occurs between the driving box and wheel hub, and the causes to be a bending moment $M b$, whose lever arm is the distance from the center of the main rod bearing on the crank pin to the inside hub face, and a twisting moment $M t$, whose lever arm is equal to the crank radius. In addition to these forces, there is a bending moment due to the load on the driving box, and a shear at the hub from the same cause; but the first two effects only will be considered, for the reason that if the axle is properly designed for those stresses, there need be no fear of trouble from the others. The bending moment $M b$, when the crank is on the centers, equals the pressure on the piston multiplied by the lever arm through which it acts. The pressure on the piston equals area of the latter. $283.52 \times 180 = 51{,}033.6$ pounds. The distance from the center of main pin bearing to inside of wheel hub may be taken at 15 inches. $M b$ will then equal $51{,}033.6 \times 15 = 765{,}504$ inch-pounds, tending to break the axle at the driving box. The twisting moment $M t$ equals the pressure on the piston, neglecting the angularity of the connecting rod, multiplied by its lever arm, 12 inches, when the pin is on the quarter, or $51{,}033.6 \times 12 = 612{,}403$ inch-pounds, tending to twist off the axle. To combine these stresses of flexure and torsion by Poncelet's theorem, when $M b$ is greater than $M t$, make $Mb = 0.975\, M b + 0.25\, M t$. We then have: $M b = 0.975 \times 765{,}504 + 0.25 \times 612{,}403 = 746{,}366 + 153{,}100 = 899{,}466$ inch-pounds. By the formula

$$S = \frac{Mb\, c}{I}$$

in which S equals unit stress, $M b$ the bending moment, c equals the distance from the neutral axis of the section to the outermost fibers, and I the moment of inertia. For the 8-inch axle, the distance c equals 4 inches, and the moment of inertia for a round section equals $0.7854\, r^4 = 201.04$ in this case. Substituting the values for the letters in the formula, we have: $S = 899{,}466 \times 4 \div 201 = 17{,}900$ pounds per square inch fiber stress, provided the axle has to resist the total strain by reason of lost motion in the side rods, or when the latter are disconnected. When all parts are in good working condition the strains are supposed to be transmitted from the main pins to two or more pairs of wheels, in which case, if two pairs are connected, the 17,900 pounds would be divided by 2, making a fiber stress of 8,950 pounds per square inch, a safe figure to work to for this purpose.

"Light Locomotives" is the title of an illustrated catalog recently published by H. K. Porter & Co., Pittsburg, Pa. This is a very handsome volume, profusely illustrated and containing a great deal of information about small locomotives, both steam and pneumatic, used for industrial purposes. We will give fuller particulars about this very useful catalog in a future number.

The Boston Belting Company were recently spoken of very highly by the "Mercantile and Financial Times," which gave a very interesting sketch of their sixty-nine years of business existence. Starting as the Roxbury Rubber Company, then changing to the Goodyear Manufacturing Company, in 1845 it became the Boston Belting Company, as it is known today. Its continued success speaks volumes for its management, and the present general manager, Mr. James Bennett Forsyth, bids fair to make its success more certain. As with any permanent business success, the goods are of high quality—the other kinds cannot exist as these have.

We notice that some of the English engineers who are always exclaiming "Lies!" when any unusual feat of fast train running is reported from America, are particularly savage in denouncing the reports that the summer trains on the Atlantic City Railroad were run at an average speed of 69 miles an hour. One ingenious critic has discovered a new explanation of how American railroad men are able to report train velocity unheard of in his dear little island. He says, in the London "Engineer," that the American mile is only 5,000 feet long, which accounts for the reputed speed, which is no speed to speak of when reduced to accurate figures. How a journal with editors that are not imbecile idiots can permit such drivel to be injected into their columns is something that ordinary human beings cannot comprehend.

Importance of Railroad Interests.

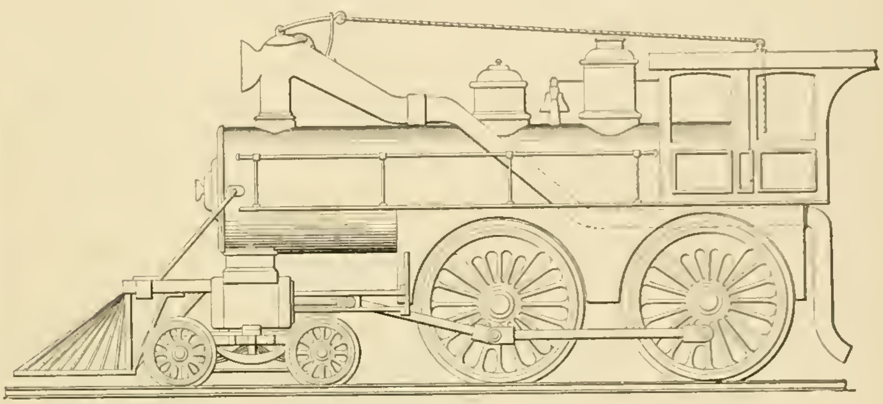
There is no one single interest in the world, says Robert P. Porter in the "Philadelphia Inquirer," as great as that of railways. Including street railways, there are to-day in operation in the world over 450,000 miles of railways.

The policy pursued by National and State legislatures towards our railways is not only a mistaken one from the investor's standpoint, but even a greater mistake from the standpoint of the wage earner. The English roads are better equipped than the American, and hence employ, relatively to their mileage, a far greater number of hands. This would naturally be the case, because the traffic is more concentrated, but aside from this fact there is no necessity for the English railways to economize as to their labor. For example, in the offices we find to every mile of road in England twenty-eight clerks and only one in the United States. England has ten station masters to our three; seven guards or conductors to our one and a half; three trainmen to our one; twelve engineers, machinists and carpenters to our one; thirteen trackmen to our three, and so on down the list. To make a long story short, the English roads are kept up, and of late years our roads have, through no fault of the management, been allowed to run down. It is true the English companies have obtained a high average rate, and in spite of the legislation of 1888-92 and 1894, in fixing maximum rates, etc., are still obtaining it. The country, however, is getting it all back in improved properties, and better facilities. A bankrupt road blights and withers, while a prosperous road vivifies trade and employs labor. It has been well said that if the railway companies of England were to hold their hand for a single twelvemonth, to cease their habitual expenditure of $75,000,000 to $100,000,000 per annum in addition to their existing accommodation, the trade of the country would receive a blow whose effect all the patent nostrums of populist legislation would scarcely avail to alleviate, much less to cure. Fortunately for the British railway manager, he is not made the annual prey of these panaceas, but allowed to run the business of railroading on business principles. The results we have seen.

A Freaky Spark Arrester.

Another addition has been made to the collection of freak spark arresters which have been patented in recent years, as will be seen by the accompanying engraving.

The front opening of the stack, which would do credit to the muzzle of a blunderbuss, is evidently intended to help the draft and carry the collection of steam and sparks back through a divided pipe to aid in ballasting the roadbed. Comment is unnecessary. Any practical railroad man can see the futility of such a device. We would suggest, however, that there is one point lacking to make it a model apparatus—on paper. The pipes should lead into the firebox and burn the sparks over again.



FREAK SPARK ARRESTER.

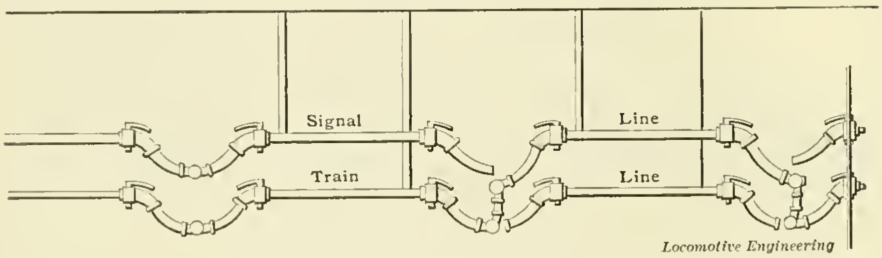
The Wabash Railroad have commenced running sleeping cars between St. Louis, Mo., and Los Angeles, Cal., by means of connection over the Atchison, Topeka & Santa Fé. The service from St. Louis is a vestibule, ten-section double drawing-room sleeper, and a free reclining chair car to Kansas City. At Kansas City two magnificent sleepers and dining cars are attached to the train and run right through to Los Angeles.

Mr. George H. Daniels, general passenger agent of the New York Central & Hudson River Railroad, is waging a most vigorous war against ticket scalping. He made a most forcible address against the evil of ticket scalping before the National Association of Merchants and Travelers at the convention held in Chicago, and he is sending out a great deal of excellent literature upon the subject.

An Unfounded Patent.

In October number we made passing reference to a recently granted patent whereby a short piece of rubber hose, with an air brake coupling on one end, and a signal pipe coupling on the other, is used to run the air through the signal pipe of a car in event of the air brake pipe becoming disabled. To the many railroad men who have been using this scheme for several years past, the granting of a recent patent will seem strange.

We believe that Mr. Pulaski Leeds, superintendent of motive power of the Louisville & Nashville Railroad, is the pioneer user of this device. To our personal knowledge Mr. Leeds employed this scheme as far back as 1889. In 1892 this coupling was made a part of the tool equipment of every passenger engine on the L. & N. system, and instructions regarding its use were posted in every inspector's shanty and on every bulletin board on the L. & N. system. This fact clearly antedates and shows priority of invention to such an extent as to have made this device public property at the time the patent was applied for, and especially so from the fact that these rules and these appliances were located at a point where it was not only possible, but very probable, that the alleged inventor could, and should have seen them.



AN OLD DEVICE NEWLY PATENTED.

For the reasons given the patent appears utterly unfounded, and we do not see how the alleged inventor can expect to sell an article to railroads which they have been continuously using and have considered public property for several years past.

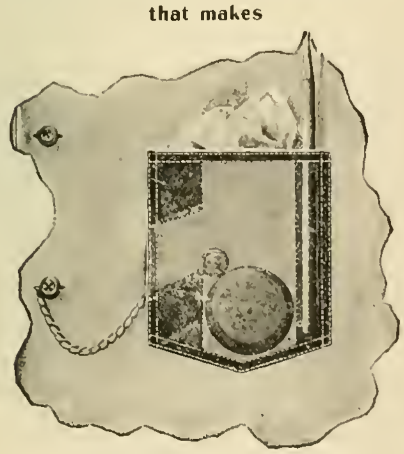
The Monitor No. 9 injector of 1897, designed for high boiler pressures, can be worked under a range of boiler pressures from 25 pounds to 300 pounds, with the water regulator at its minimum point of delivery opening, without a break. This feature, taken in connection with the fact that the regulator requires no manipulation for a fine boiler feed, other than to throw the handle full forward, is one that will be appreciated by engineers, as no waits are necessary to know the machine is working at its finest feed, without probability of breaking. Fine graduation of feed, under any pressure, is the strong point claimed for this instrument. An order for thirty of these improved injectors is now being filled for the Chicago, Rock Island & Pacific Railway, twenty of which have been delivered.

"The finest book I have ever seen," is the general expression from the people who have bought the World's Rail Way. The book is selling rapidly and it looks as if the whole edition would soon be exhausted. A curious thing about the sale of this expensive book is that about half the orders come from railroad men abroad, and that a very small percentage of those sold in this country are purchased by railroad men. Quite a number of copies have been purchased to give away as presents, and it is particularly suited for that purpose, as it is likely to be kept in evidence and is not likely to disappear in smoke.

We have received from the General Agency Company, of New York, an illustrated catalog of the Smith triple expansion exhaust pipe for locomotives. It gives a variety of views of this excellent device, and prints rules relating to the application of the pipe. If these rules were strictly adhered to, there would never be any complaint about the pipe failing to give satisfaction. Every man running a locomotive equipped with the Smith triple expansion exhaust pipe should have this little descriptive catalog in his pocket. A reduced cut of our front cover is used for the front cover of this catalog.

The Blake Steam Pump Works, Boston, Mass., now has the largest Eberhardt's automatic gear cutter ever built, for cutting spur gearing of the coarsest pitches, 100 x 20-inch face, weighing about 8 tons. Gears of many tons weight can be put into the machine and taken out without changing any adjustments. Larger cutters are used and coarser pitches cut than on any machine ever built. It possesses improvements never before put upon the market, and is supplied with cutters specially adapted for automatic machines.

The New York, New Haven & Hartford Railroad Company have decided to build large shops on their Providence division, about twenty miles out of Boston. The intention is to concentrate nearly all repairs of locomotives at that point.



Specification for Locomotives Built Fifty Years Ago.

Men interested in the development of the locomotive will find some curious particulars in the specification advertised fifty years ago by the chief engineer of the Baltimore & Ohio Railroad. A copy of the specification annexed has been sent us by Mr. J. Snowden Bell, of Pittsburg, Pa., who vouches for its authenticity. It might be added that the Baldwin Locomotive Works secured the order:

"Proposals under seal will be received by the undersigned up to Saturday, the 6th of November, inclusive, for furnishing the Baltimore & Ohio Railroad Company with four locomotive engines, in conformity with the following specification:

1. The weight not to exceed 20 tons, of 2,240 pounds, and to come as near to that limit as possible.

2. The weight to be uniformly distributed upon all the wheels when the engine is drawing her heaviest load.

3. The number of wheels to be eight.

4. The diameter of the wheels to be 43 inches.

5. The four intermediate wheels to be without flanges.

6. The boiler to contain not less than 1,000 square feet of fire service, of which there shall be not less than one-fifteenth in the firebox.

7. The tubes of No. 11 flue iron, with not less than ¾ of an inch space between them in the tube sheets.

8. The firebox, with the exception of the tube and crown sheets to be of ⅔-inch copper.

9. The tube sheets to be ⅜ inch thick.

10. The boiler to be of No. 3 iron, of the best quality.

11. The firebox to be not less than 24 inches deep below the cylindrical part of the boiler.

12. The steam to be taken to the cylinder from a separate dome on the fore part of the boiler.

13. The frame, including the pedestals, to be entirely of wrought iron, and the boiler to be connected therewith, so as to allow of contraction and expansion without strain on either.

14. The cylinders to be 22 inches stroke, and not less than 17 inches diameter.

15. The cut-off to be effected by a double valve, worked by separate eccentrics.

16. The angle of the cylinder to be not greater than 13½ degrees with the horizontal line.

17. The frame and bearings to be inside the wheels, and the connection from the cylinder direct with the back pair of intermediate wheels.

18. The centers of the extreme wheels to be not more than 11½ feet part.

19. The wheels to be of cast iron with chilled tire.

20. The means to be provided of varying the power of the exhaust in the blast pipe.

21. The engine to be warranted to do full work with Cumberland or other bituminous coal, in a raw state, as the fuel, and the furnace to be provided with an upper and lower fire door with that view.

22. The smoke-stack to be provided with a wire gauze covering.

23. Two safety valves to be placed upon the boiler, each containing not less than 5 square inches of surface, and one to be out of the reach of the engineman.

24. The tender to be upon eight wheels, and constructed upon such plan as shall be furnished by the company, and to carry not less than three cords of wood, or its equivalent in coal, and 1,500 gallons of water.

25. The materials and workmanship to be of the best quality, and the engine to be subjected to a trial of thirty days' steady work with freight upon the road, before acceptance by the company.

Payment to be made in cash on acceptance of the engine. The four engines to be delivered at the company's Mount Clare depot, in Baltimore; the first on the 1st of February, 1848, and the three others on the 1st of March, April and May ensuing.

The track is 4 feet 8½ inches gage, and the shortest curve of the road is 400 feet radius.

The company to be secured against all patent claims.

Further information will be communicated upon application to the undersigned, at the company's office, No. 23 Hanover street, Baltimore, to which the proposals suitably endorsed will be addressed.

By order of the President and Directors.

BENJ. H. LATROBE,
Chief Engineer and Gen. Superintendent.
Baltimore, Sept. 18, 1847."

Nearly every railroad in the country is using fire-brick arches, crucibles and other refractory articles that have to stand intense heat, but very few railroad men know much about the constituents of these articles, and few of them can distinguish the quality of the articles purchased. Those who wish to obtain useful information about these things should send to the Garden City Sand Company, Security Building, Chicago, for their illustrated catalog on fire brick.

Owing to the rapidly growing demand for the Lunkenheimer brass and iron specialties for steam, water, gas, etc., they again enlarged their facilities by adding a four-story building, 50 x 50 feet, which has been fitted up for general offices. The old offices are being converted into shops for manufacturing purposes.

A Slow Train.

There has always been good-natured rivalry between the Grand Trunk and the Canadian Pacific Railways, and the rival employés are always telling stories that reflect upon the other side. The Canadian Pacific men insist that the older road is noted for sluggish movements, and that the men are as slow as the trains.

They tell an anecdote about an English traveler who was making a journey on the Grand Trunk, and who was by no means well impressed with the train speed. Shortly after the train started, a succession of shrieks were heard from the whistle of the locomotive, and the Englishman wanted to know what was the matter. "Cow on the track," said the conductor. About an hour afterwards the peculiar kind of whistle was repeated, and the traveler remarked, "'Ave you not caught up with that cow yet?"

The Buffalo Forge Company, of Buffalo, N. Y., have just received orders to build the fans and engines required for torpedo boats Nos. 12 and 13. Four blowers are required for this installation. The engines are direct attached to the fans; every fan is of a special design to suit the space in which it is to be placed. The capacity of each fan provides for supplying air for 900 indicated horse-power of boilers. The system of forced draft is the enclosed stokehold, air pressure being about 3 inches. The engines are of a special type having enclosed cylinders to prevent dust getting into the reciprocating parts.

W. W. Pitts, Hillsboro, Texas, asks the readers of "Locomotive Engineering" a question that he finds a great difference of opinion on among engineers and mechanics, namely: "Does the back-up eccentric have any effect on the point of cut-off—that is, impart any of its motion to the valve, while an engine is hooked up and moving ahead?" Everybody who has studied link motion closely is aware that the back-up eccentric exerts a very decided influence on the point of cut-off when the engine is hooked up; but we are willing to have the views of those who think otherwise.

A German paper maker recently tried to see how quickly paper could be made from the tree, and accordingly three were cut one morning at 7:35 A. M., and started on their journey toward paperdom. At 9:34 the first sheet was finished, a minute less than two hours after it had been in the forest. A few sheets were taken to a printer, 2½ miles away, and at 10 o'clock a printed paper was in the hands of the paper maker. A notary was dragged around to witness the operation as well as the truth of the paper makers. "These do be swift times, shure."

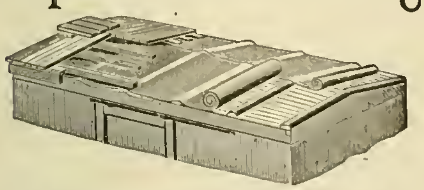
The Lake Shore & Michigan Southern management have decided to array their engineers and firemen in uniform suits of clothes. During a recent visit to the office of Mr. G. W. Stevens, superintendent of motive power, we found a committee of selection helping to decide which, amid a variety of forms, colors and textures, would be likely to give most satisfactory service. We believe that the Lake Shore is the first road in this country to equip their engineers with uniforms. The practice is quite common in European countries.

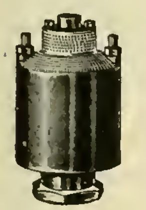
The Boston Belting Company, 256 Devonshire street, Boston, have issued a small memorandum book suitable for the vest pocket, which contains a great deal of useful information about vulcanized rubber boots, belting, hose and other varieties of goods made by the company. There is also information regarding packing, gaskets, etc. The book contains a number of blank pages suitable for memoranda. It will be sent free of charge to any of our readers interested in this line of goods, on application.

The Davis & Egan Machine Tool Company, of Cincinnati, report that they have received more orders from this country during the past three weeks than they received during any previous two months of the year. They have secured an order from the Krupp Works, of Essen, for a number of machine tools. They have also received, through their Berlin office, a large order for lathes, shapers, drill presses, etc., from another large manufacturing establishment in Germany.

"Self Help" is the title of a journal published by the National Correspondence Schools, of Scranton, Pa., to make known the merits of correspondence instruction in technical subjects and drawings. Every youth trying to help himself or herself to a better education should send for this publication, which is free to all applicants of an inquiring turn of mind.

We would suggest that persons sending stamps in payment for orders would kindly wrap them in a separate piece of paper. When enclosed in the letter, they most always stick to it, and cause much inconvenience, the letter having to be soaked or torn to pieces in order to remove the stamps.





The Cooke Locomotive & Machine Company have received an order from the Astoria & Columbia River Railroad Company for three ten-wheel locomotives. They are to have cylinders 20 x 26 inches, and to be equipped with all the most modern appliances. They are similar in design to a large number of engines recently turned out by this company for the Southern Pacific Company. An order has been booked by this same company for the Oregon Railroad & Navigation Company for five ten-wheel locomotives, having cylinders 20 x 26 inches. These locomotives are to carry 200 pounds of steam, and are intended for heavy freight work.

The Long Island Railroad branch of the Young Men's Christian Association has issued a very handsome pamphlet, giving particulars of the attractions to be found in the establishment during the coming year. They are doing a very valuable work among railroad men, and this particular branch is eminently well managed. Anyone who wishes to see how interesting and attractive this kind of a branch can be made to railroad men should apply to Mr. Neason Jones, 45 Borden avenue, Long Island City, N. Y., for a copy of the pamphlet.

Manning, Maxwell & Moore, Liberty street, New York, have recently put upon the market the Milliken patent bicycle drill for all kinds of drilling, reaming and counter-sinking. "Bicycle drill" does not mean that its use is in the manufacture of bicycles. It is a drill intended for all kinds of work, and operated by a man in the same way that a bicycle is run. Those interested in any new conveniences for doing work where stationary tools are not convenient should send for a descriptive catalog of this machine.

The Q. & C. Company, Chicago, have added to their list of railroad equipment an inside check valve for locomotives. It is the best safety device of that character ever invented, and we are glad to see such a pushing firm as the Q. & C. putting it upon the market. The check valve was invented by a practical railroad man and was illustrated on page 243 of "Locomotive Engineering" last year. They have also arranged to handle the Priest snow flanger, which is the best of its kind.

Consuls abroad are continually reminding American manufacturers of their shortcomings in the matter of price-lists, and it would be well if these hints were more generally taken. Price-lists, to be of use in a foreign country, should be net, and not subject to complex discounts, as has become customary in domestic trade, where 75 and 5, and 5, and 3 per cent. discounts are indulged in.

The Lodge & Shipley Machine Tool Company, of Cincinnati, O., have issued a new illustrated catalog, showing their lathes and other machine tools. The illustrations give a very good idea of the appearances of the various tools, and there are plain reading descriptions accompanying them. The catalog is of standard size, and ought to be in the file of every tool purchaser in the country.

"Carey's Coverings" is the title of an illustrated catalog sent out by the Philip Carey Manufacturing Company, Lockland, O. Its purpose is to show how lagging should be applied to steam pipes, boilers and other places where something has to be used to prevent the dissipation of heat. The illustrations are very plain, and the catalog will be found a very useful source of reference.

Piston packing is converted into water packing at the Great Northern Railway shops, St. Paul, by grooving each ring of the ordinary steam packing with a groove 3-16 inch wide and deep. A close watch on its performance by General Foreman Dickson shows less wear on the rings and cylinders, both having longer life in consequence, and the cylinders never cut.

P. T. Barnum once said: "If you have $10 to put to good use, put $1 for the article and the other $9 for advertising. I can out-talk any man but a printer. The man that can stick type and the next morning talk to a thousand people while I am talking to one is the man I am afraid of and I want to be his friend."

Mr. G. W. Hoffman, Indianapolis, Ind., reports that his business has increased so of late that he has been obliged to enlarge his building. He is the manufacturer of the "U. S." Metal Polish Paste, which has no equal as a polish for all kinds of planished metals. Trial samples will be sent on receipt of 2-cent stamp.

The United States Metallic Packing Company, of Philadelphia, have issued an illustrated catalog showing, besides their various kinds of packing, a variety of pneumatic tools, hammers, drills, sanders and bell ringers. Those interested in these appliances will find the catalog very useful to carry in the pocket.

Persons interested in studying the inside mechanism of steam regulating devices, valves, pumps, pressure governors, etc., should send to the Mason Regulator Company, 6 Oliver Street, Boston, for their price list and catalog, recently published. It is a convenient hand book suitable for the pocket.

INDEX TO ADVERTISEMENTS.

Buyers' Finding List.

AIR BRAKE HOSE.
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N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

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Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co., Philadelphia, Pa.
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National Malleable Castings Co., Chicago, Ill.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

(Continued on page 860.)

BUYERS' FINDING LIST—*Continued.*

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Safety Car Heating & Lighting Co., New York.

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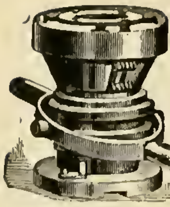

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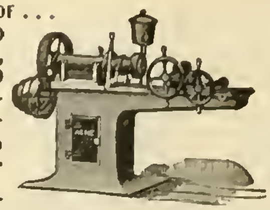

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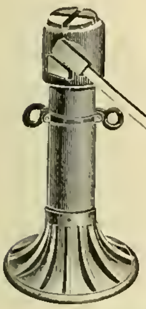

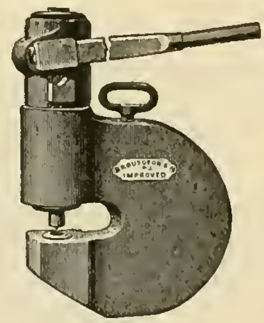

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(*Continued on page 862.*)

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(*Continued on page 863.*)

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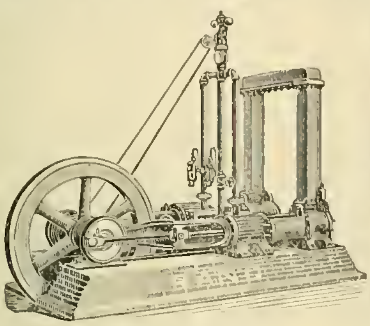

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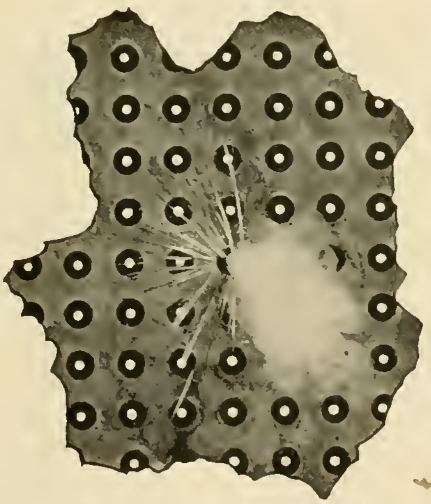

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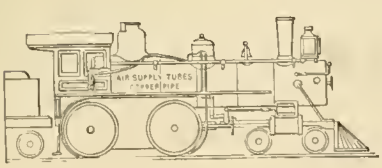

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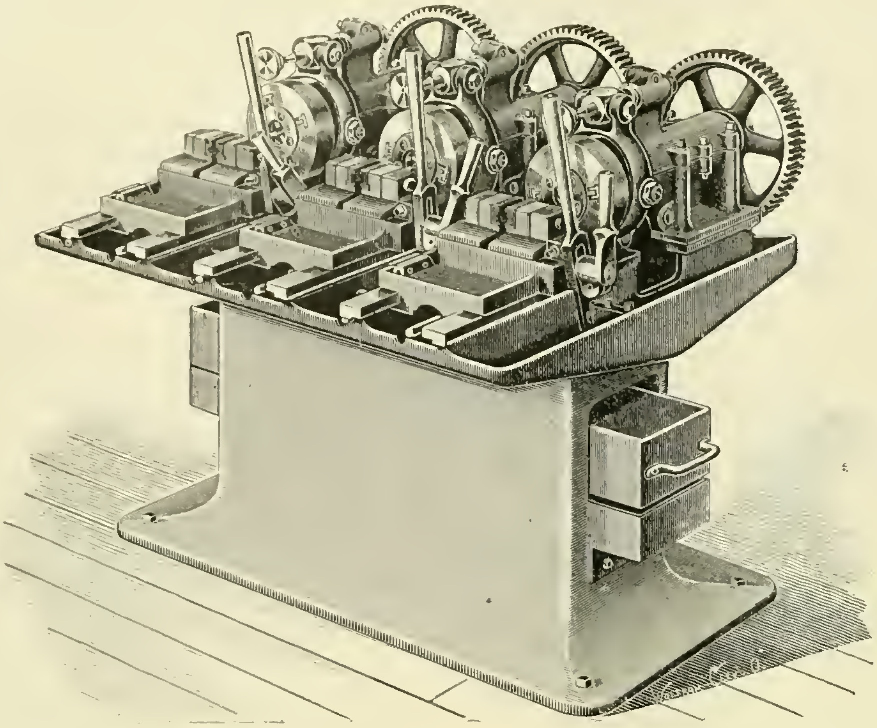

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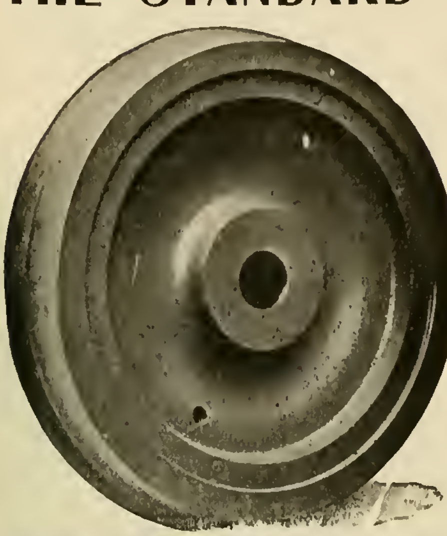

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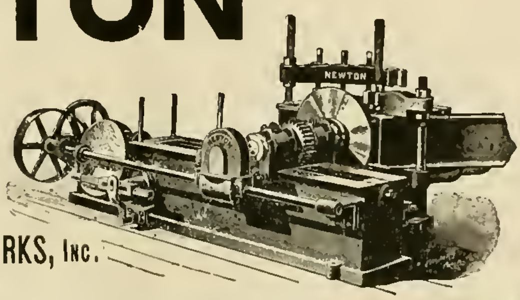

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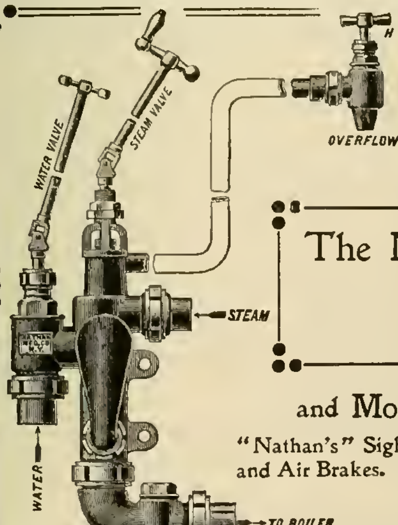

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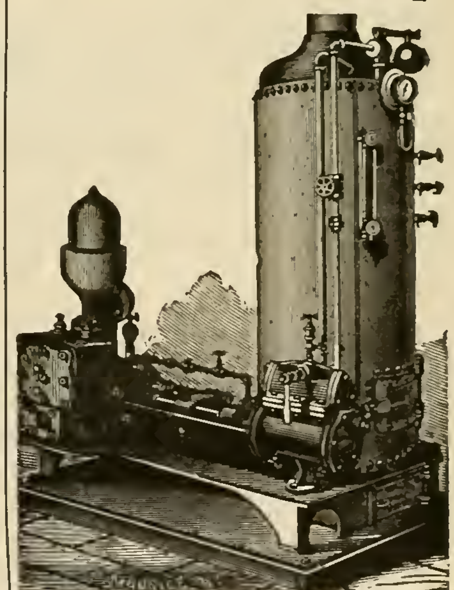

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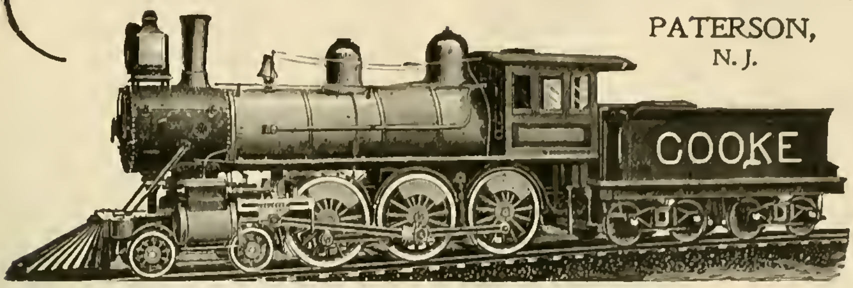

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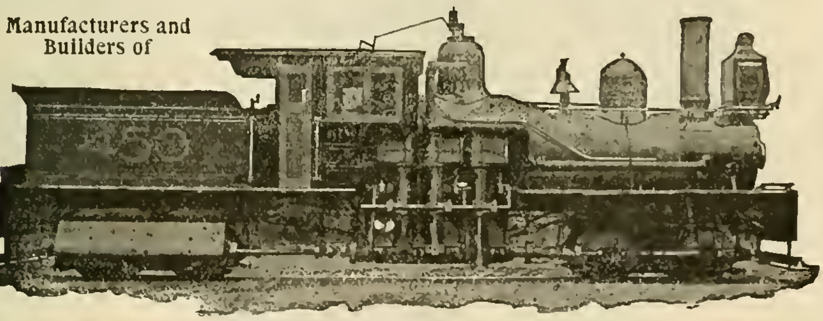

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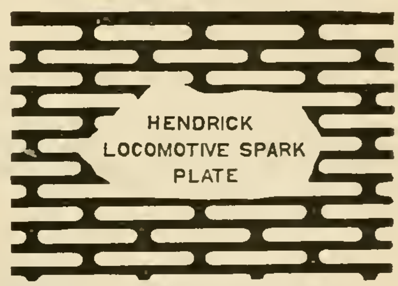

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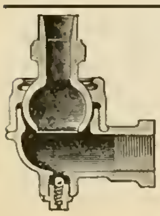

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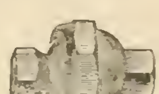

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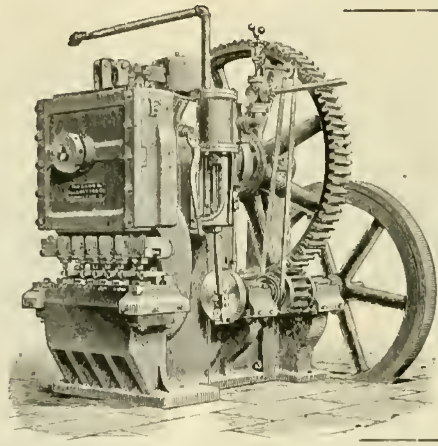

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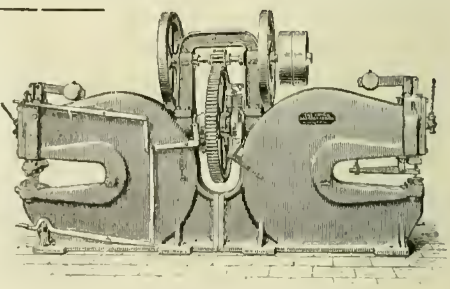

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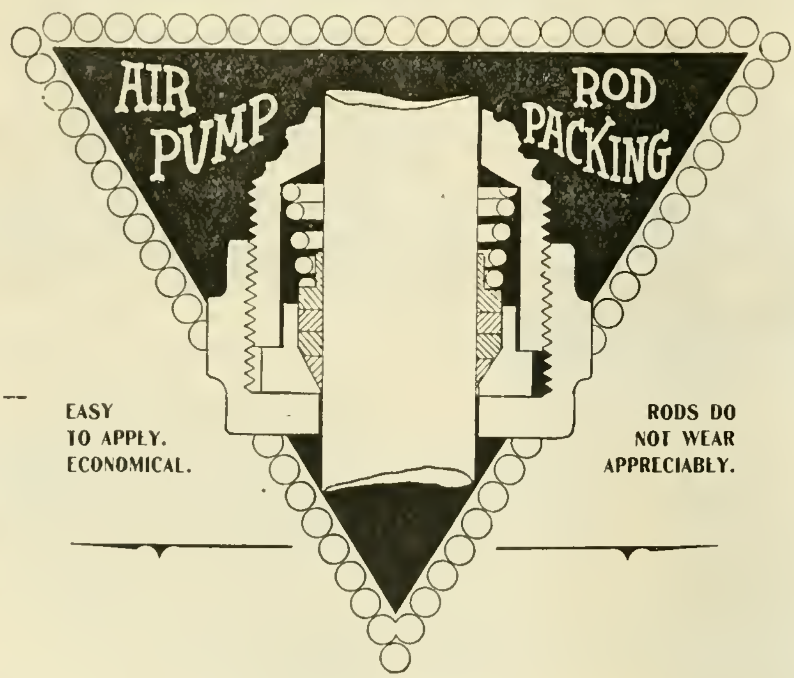

Give Size and Make of Pump.

If Rods have been Reduced, give Size.

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LOCOMOTIVE ENGINEERING

A PRACTICAL JOURNAL of RAILWAY MOTIVE POWER AND ROLLING STOCK.

[Trade-Mark Registered.]

Vol. X. NEW YORK, DECEMBER, 1897. No. 12.

Subscribers who bind or file the year's volume of "Locomotive Engineering," and wish to use an index for reference, can obtain one by applying to this office.

Ten-Wheeled Passenger Locomotive—Pittsburgh & Western Railway.

The Pittsburgh & Western Railway have lately received some ten-wheelers built for their passenger service, at the Pittsburgh Locomotive and Car Works. Our engraving shows these engines to be distinctively in the front rank of simple engine practice with 20 x 26-inch cylinders, and 68-inch driving wheels, with 113,000 pounds to hold them to the rail.

The work demanded of these engines is of an exceptionally severe character, being on grades of from 80 to 90 feet per mile, and a maximum draw-bar pull of 22,000 pounds is provided for starting. This may be depended on under the most adverse condition of rails, since the weight on drivers gives a co-efficient of adhesion of five.

Several marked points of good practice in the design and location of parts will be noted in the engraving, among which are safe and sensible steps and handholds at each end of the tank, the air pump on the left hand side, the step at the side of the pilot—all of these and others not necessary to enumerate, since they show for themselves, are not only conveniences, but measures of safety as well. The engines will be better understood by a reference to the following description:

Type—simple, ten-wheeled.

Fuel—bituminous coal.

Total weight of engine in working order—145,000 pounds.

Total weight on driving wheels—113,000 pounds.

Driving wheel base of engine—13 feet, 8 inches.

Total wheel base of engine—24 feet, 6 inches.

Total wheel base of engine and tender—51 feet, 9½ inches.

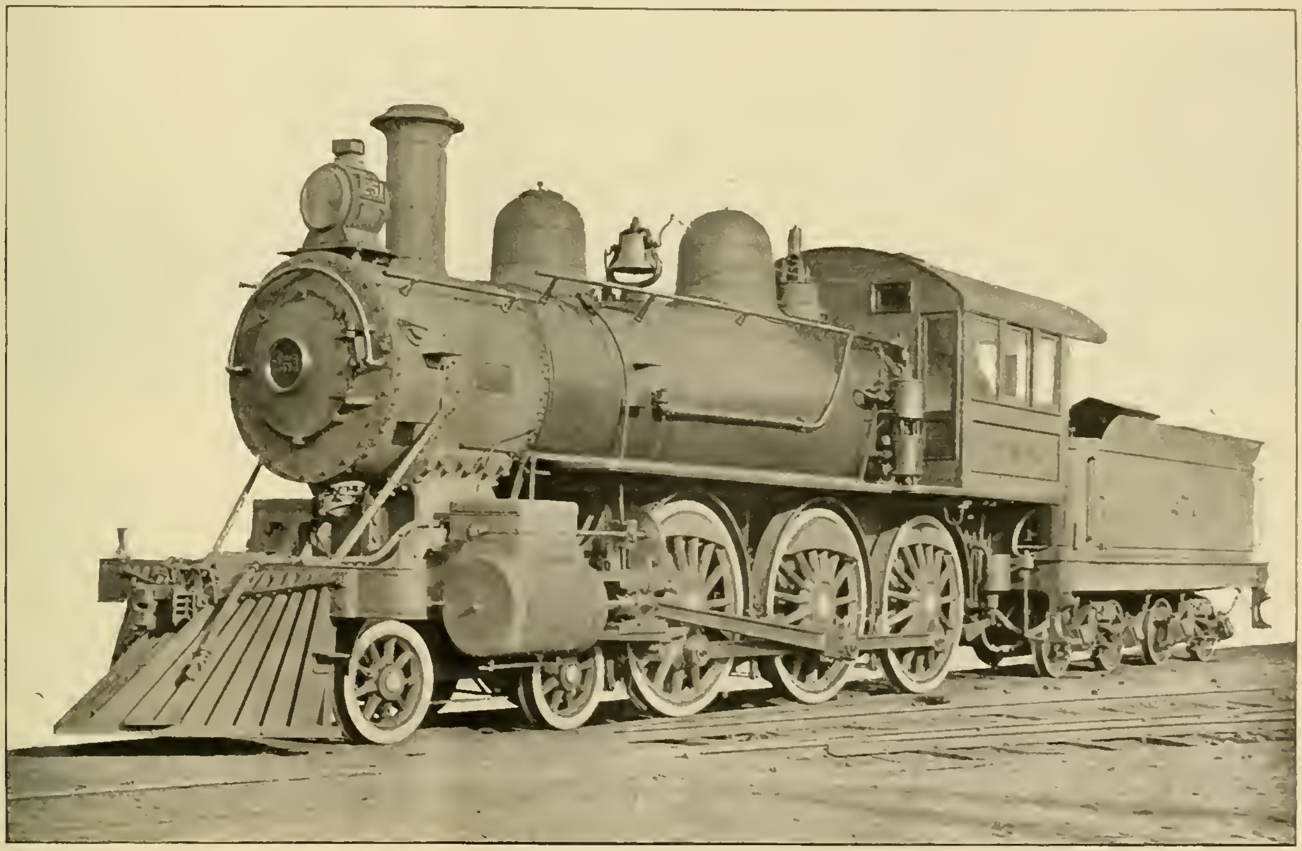
Hight from top of rail to top of stack—14 feet, 7¼ inches.

Cylinders, diameter and stroke—20 x 26 inches.

Piston rods, steel, diameter—3½ inches.

Type of boiler—extended wagon top.

Diameter of boiler, smallest ring—60 inches.



PITTSBURGH TEN-WHEEL PASSENGER ENGINE.

Diameter of boiler, back head—71⅛ inches.

Radial stays at crown—1⅛ inches diameter.

Staybolts—1 inch diameter.

Staybolts, spacing—4 inches from center to center.

Number of tubes—231.

Diameter of tubes—2¼ inches.

Length of tubes over tube sheets—14 feet, 6 inches.

Length of fire box inside—108 inches.

Width of fire box inside—42 inches.

Boiler pressure—180 pounds.

Kind of grates—rocking.

Area of grates—31.5 square feet.

Heating surface in tubes—1961.3 square feet.

Heating surface in fire box—158 square feet.

Total heating surface—2119.3 square feet.

Diameter of driving wheels—68 inches.

Diameter and length of driving journals—8 x 10 inches.

Diameter of engine truck wheels—32 inches.

Diameter and length of engine truck journals—5 x 10 inches.

Slide valves—American balanced.

Water capacity of tank—4000 U. S. gallons.

Fuel capacity of tank—280 cubic feet.

Weight of tender with fuel and water—77,000 pounds.

Type of brakes—Westinghouse American.

Train signal—Westinghouse.

The Oregon Short Line management have decided to adopt the R. Usher oil can, made famous by Jim Skeevers. Every can will be nickel plated, with the idea that the men will take better care of them than they would of a less attractive looking can.

Chicago, Milwaukee & St. Paul Compound Ten-Wheelers.

The annexed illustration shows one of the 14 compound ten-wheelers recently built by the Baldwin Locomotive Works for the Chicago, Milwaukee & St. Paul. The principal dimensions of the engines are as follows:

Cylinders—Vauclain compound.

High pressure 13½ diameter and 26 inches stroke.

Low pressure, 23 inches diameter and 26 inches stroke.

Three pairs coupled wheels, four wheeled center bearing truck.

Weight in working order—total, 148,000 pounds.

Boiler—11-16 inch steel, butt jointed, with double covering strips; 60 inches diameter at smoke box end, with straight top; working steam pressure, 200 pounds.

Tires—Krupp crucible steel, 3 inches thick; front and back pairs flanged; middle pair plain.

Driving axles—hammered iron; journals, 8 inches diameter, 12 inches long.

Driving boxes—steeled cast iron; bearings, Damascus bronze.

Springs—underhung.

Connected and parallel rods steel fluted; parallel rods with solid ends and heavy bronze bushing.

Supplied with two No. 10 Ohio injectors, both placed on right side of locomotive; line check in each pipe near injector.

Eccentric straps of Damascus bronze.

Leach sanding device; circular headlight. C., M. & St. P. standard.

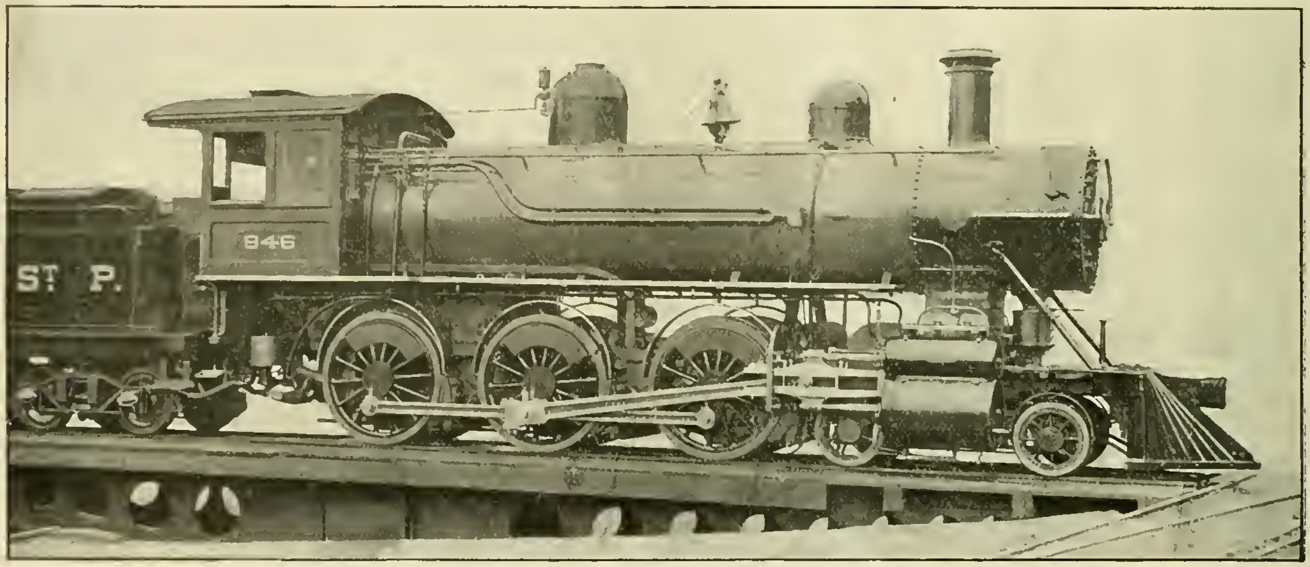
Westinghouse outside equalized air brake for all driving and tender wheels, with 9½ inch pump.

Jackets specially arranged to be readily removed to get at staybolts.

Boiler fitted with sectional magnesia lagging.

Capacity of tank—3,800 gallons.

Tender trucks—C., M. & St. P. standard; contracting chill wheels, and company's standard iron brake beams.



LATEST C., M. & ST. PAUL FREIGHT ENGINE.

A Long Man in a Small Sleeping Car Berth.

There was one story of his career that the late George M. Pullman used to tell with manifest delight. It was as follows:

"One night, going out of Chicago, a long, lean, ugly man, with a wart on his cheek, came into the depot. He paid George M. Pullman 50 cents, and a half berth was assigned him. Then he took off his coat and vest and hung them up, and they fitted the peg above as well as they fitted him. Then he kicked off his boots, which were of surprising length, turned into the berth, and, having an easy conscience, was sleeping like a healthy baby before the car left the depot. Along came another passenger and paid his 50 cents. In two minutes he was back at George Pullman.

"There's a man in that berth of mine," said he, hotly, "and he's about 10 feet high. How am I to sleep there, I'd like to know? Go and look at him."

In went Pullman—mad, too. The tall, lank man's knees were under his chin, his arms were stretched across the bed, and his feet were stored comfortably—for him. Pullman shook him until he awoke, and then told him if he wanted the whole berth he would have to pay $1.

"My dear sir," said the tall man, "a contract is a contract. I have paid you 50 cents for half this berth, and, as you see, I'm occupying it. There's the other half," pointing to a strip about 6 inches wide. "Sell that, and don't disturb me again." And, so saying, the man with a wart on his face went to sleep again. He was Abraham Lincoln.

The Gilderfluke Locomotive.

BY ELI GILDERFLUKE.

The appalling wastes and extravagances incident to the operation of the steam locomotive have ever been the subject of much fruitless wrangling and soul-harrowing argument, tending in the direction of matters of trivial import and along traditionally beaten paths.

The inventor with a courage born of his convictions had not yet arisen. Some of those born out of time, Fontaine, Swinnerton, Raub and the great Holman, carried the germs of improvements to overcome these wastes, in part,, but their efforts have been ill-timed, and they have suffered a martyrdom to the causes they have variously essayed, through a public lack of appreciation, and a studied disregard of proven economics of their systems by wobbly kneed officials, to whom the slightest remove from olden-time practices was a capital offence.

There are still those who, in a feeling of antagonism to departures from the worship of methods moss grown, will question some of the many economical innovations here appearing for the first time in locomotive construction. "Haec olim meminisse juvabit."

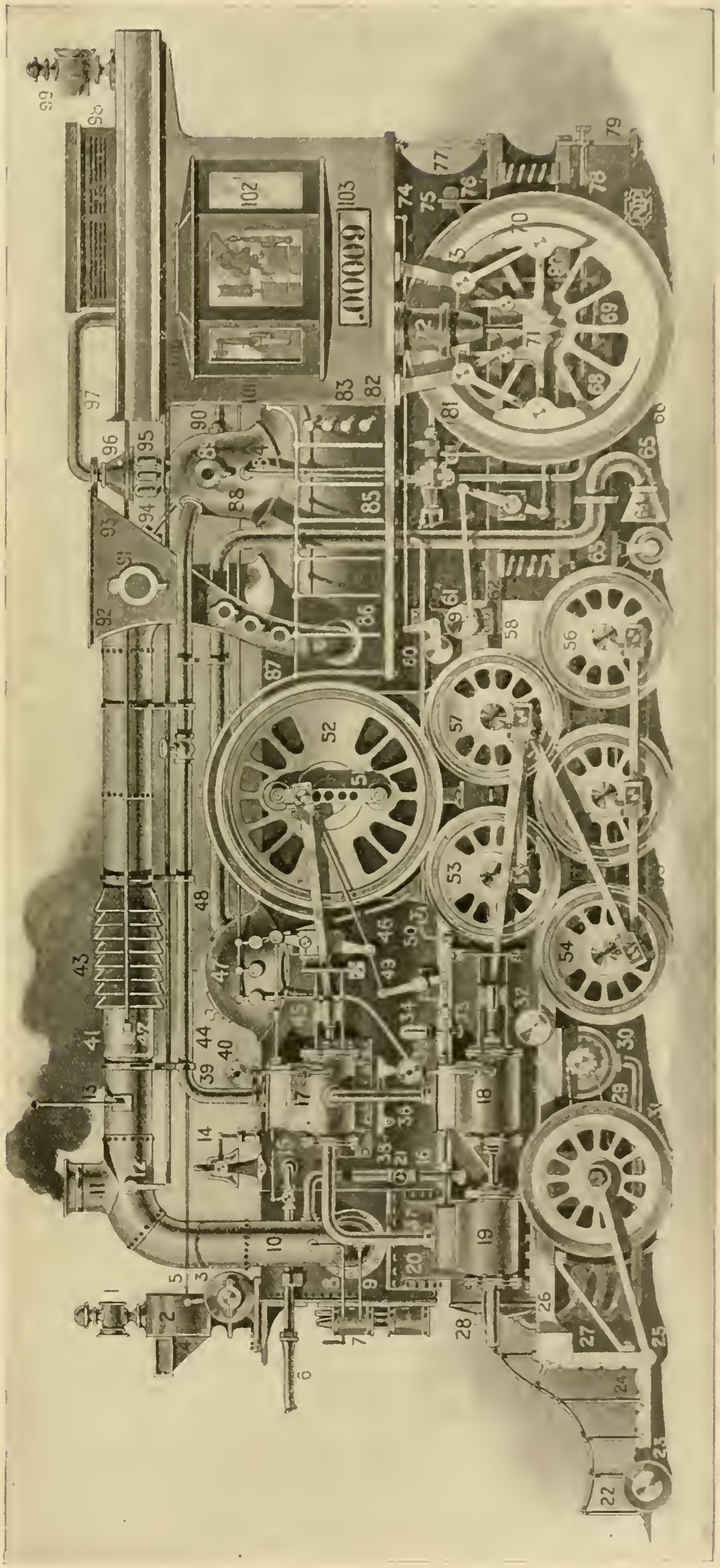
A brief description of a newly devised and highly economical engine follows herewith, reference being made to numbers as appearing on engraving.

1 is a small head or signal lamp, burning kerosene, and is a substitute or understudy for the high-power electric searchlight, should the electric light fail in operation from any derangement of wires, or should bugs, attracted by the light, clog the dynamo or light exciter. Should bugs be attracted in such quantities as to seriously impede the movement of trains, it is suggested as a remedy, the painting of front end of engine with an insecticide, and the spraying of the right of way with a saturated solution of bichloride of mercury and alcohol, carried in a suitable receptacle placed on the tender of engine. The spraying to be accomplished by the use of compressed air.

2 is a high-power triple X-ray electric search-light of 9,340 candle-power, to enable the engineer to see around curves and through mountains. The light exciter or persuader is driven by a small steam turbine or calorifluke 3 controlled from the cab by the lever 5. This light serves a special purpose in such parts of the country as are infested by train robbers, the X-ray feature enabling the engineer to detect the inmost thoughts of those coming within its range, and to govern himself accordingly.

4 is a side hood over reflector of lamp, the office of this hood being to keep the intense glare of the headlight from blinding the depot master.

6 is a new anti-sleep-on-the-track device, being a highly polished nozzle or hydroshove, attached to a pipe leading back to boiler, and operated by lever 15, from



GILDERFLUKE'S PERFECTED LOCOMOTIVE.

fireman's side of the cab. The object of this apparatus is, to project against the cuticles of hoboes or stray beeves upon the track, a stream of aqua pura at a temperature of 212 degrees; this is to assist the aforesaid hoboes and beeves to a realization of their danger, and to be of service in the acquirement of a hump upon themselves in the clearance of the right of way. This squirt can also be used in the winter for the melting of snow banks left by the plow.

7 is an especially designed 19-inch air brake pump, which, together with a new and improved brake rigging, will stop a train of 70 cars at a speed of 42.7 miles per hour, in 8 feet, 10 inches. This will enable an engineer to run at full speed right up to the station platform, thus saving many money-bearing minutes, now lost by the slowing up of trains entering stations or terminals.

8 and 9 are air brake pump steam exhaust and supply pipes, in the order named, the supply being taken from the dry pipe to the front cylinder of the lower tandem-compound portion of the engine.

10 is a new and vastly improved smoke pipe or carbowallop, for the swift conveyance of smoke, cinders and gases back to the fire box for re-incineration, and with a nice new lead pencil and a sheet of smooth brown paper, a saving of at least 75 per cent. in coal consumption can be easily figured, and in actual service there is no doubt but what a train of 68 cars and a short caboose can be hauled 137.49 miles per half ton of coal.

12 is a by-pass or deflectorbolus, so placed in the carbowallop as to enable the engineer, should there be too much smoke, ashes or cinders returning to fire box, thereby causing too intense a fire, to turn the smoke or gases into the stack 11, and allow them to pass to the atmosphere as shown on engraving.

41, 42, 43, are also parts of the smoke pipe or carbowallop, as aforesaid, 41 being a movable sleeve, or slipguilder, connected with petticoat pipe, 43, and operated by cab lever, 42. The wings of this petticoat pipe act as an atmosphere scoop when engine is running forward, and induce a rapid movement of the oxygen-charged smoke, together with gases and cinders, to the fire box. The forced addition of the oxygen-charged smoke makes a fire of such intensity that an engine equipped with the apparatus will burn very nearly anything, and is especially fitted for the burning of a mixture containing equal parts of culm, fine gravel and slag. The use of this composite fuel will effect a still further saving of 20 per cent., making a total estimated saving of 95 per cent. over present fuel consumption per train mile, and tons hauled.

16 is a pipe connected with compressed air reservoir, and is to be used as an auxiliary blower for the carbowallop, when engine is making steam in the house.

13 is a signal or fireworks holder placed upon the sides of the carbowallop, so as to insure a prominent display for the usual railroad signals, flags or lamps. This device is also to be used in connection with a newly designed system of weather signals, by flags and pyrotechnics, carried on the engine. This flagholder in connection with the triple X-ray electric search light, will be found especially valuable in apprising the train dispatchers of the train's location, in the event of a lap order, or when wires are down.

14 is a new steam bellringer or chimodad, a special feature being the connection between the chimodad and the bell, which prevents the bell from turning over. Other inventors have struggled for years in the solution of this problem without success.

17, 18, 19 are steam cylinders forming a trunk cross-steeple-tandem-compound system of such marked economy in steam consumption as to effect a proven saving of 87.8 per cent. over the steam consumption of the highest type of simple engines of the same draw-bar pull and under similar conditions. Improvements now making will show a still further economy in the steam consumption of 12.2 per cent., which will make a steam economy of 100 per cent.; the steam being actually used up without waste, positively no steam appearing in the stack or carbowallop. The distribution of the steam in these cylinders is very simple, but is too complex for a written description.

22 is a new and improved pilot or flipgang carried on the pony truck wheels 23, to keep the nose of the flipgang from stabbing into the ties. The conventional pilot is a rude, barbarous construction and a relic of days gone by. A swine upon the right of way, struck by this old-time pilot, would be tossed aside in a brutal manner, and in some cases seriously injured, to say nothing of the hazard of covering the front end of the engine with disrupted hog. Suits for damages resulting from the promiscuous distribution of swine over the surrounding country are entirely avoided by this new and improved device, and the saving thus accomplished will go a long way in the settlement of the pay-roll and purchases of soft hammers to be used on the sand pipes or cinder hopper.

25 is a brace leading from heel of flipgang back to the center of front bearing pony truck, and serves to keep the wheels in alignment, and prevents a wobbling motion tending to weary the fireman, and possibly leading the engine into the ditch, and resulting in the derangement of portions of the reciprocating parts.

26 is the front frame, carrying saddle and tandem cylinders.

27, 28, 29, 30, 32, 33, 34, refer to compressed-air attachment. 33 is the main compressed-atmosphere retainer or drum, atmosphere entering through the strainer 32. This strainer is for the separation of dust and bacilli from the air before it enters the circulaoxytor or blower. The introduction of the railway bacillus (Bacillus Amylobacter) into the carbowallop being a serious matter, and one hitherto overlooked in locomotive construction. The atmosphere strainer connects directly with the circulaoxytor or fan blower 30, driven by a chain and sprocket wheels from the axle of the front pony truck. The atmosphere is forced by the circulaoxytor through the coiled conducting pipe 27, and enters retainer at 28, the pressure in the retainer being controlled by a whistle safety valve 30, having a "toot that's like a hoot."

35, 40 are recording gages for determining the effected steam-saving, and are to be consulted on the arrival of train at each stopping place or terminal, and the results noted in a nice little pocket record book, especially designed and provided for the purpose.

36,37 are steam supply pipes to the cylinders, and are so very simple as to make a description unnecessary.

38 is a small pan or drip to catch water coming from the cylinder cocks and is connected with a small pipe which returns the water to the boiler for reheating.

39 is main steam supply or dry pipe placed above the boiler. The steam produced by this boiler is so very dry, and the percentage of moisture so small, that lagging of the dry pipe to prevent condensation is unnecessary.

44, 45, 46, 47, 48, 50, 63, 64, 65 have to do with the track-sanding system. 47 is the sand holder, sand being introduced through orifice closed by the cover 44. 45, 46 are sand-conducting pipes, 45 being for the conduct of sand to the rail in front of pony truck wheel 31. The forward movement of the wheel over the sand tends to break up the coarser particles and to spread the sand evenly over the rail, so that traction wheels 54, 56 get a firmer hold upon the track. Any kind of sand or fine gravel will serve the purposes required, the grinding action of the various wheels tending to reduce it to the proper fineness. 46 is a sand pipe for delivering sand upon the intermediate driving wheels, and operates to prevent slipping and heating the tires. The sand used through pipe 46, is the sand that is returned to the holder by the compressed air exhaust system. 63 is a small brush or dustoscope, just abaft the traction wheels. The object of this dustoscope is to brush the sand remaining on the rail into the funnel shaped scoop, 64, from which it is exhausted through pipe 65, by an exhaust created by compressed air pipe 50, and is thence carried to the sand holder for use over again.

This system will be found very serviceable in such localities as are deficient in sand, gravel or small rocks, and brings about an economy in sand handling, the saving of which expended in the purchase of coal will go a long way toward the earning of dividends.

49. 51 shows an amazingly simple valve and reverse motion, constructed boldly along original lines, and is as distinctly a radical remove from the common every day link as was the link from the olden time hook motion. There are those who could not invent a button for a buttery door, who will no doubt stand ready to question such a decided innovation, and in their poor, weak little intellects, will conjure up trials and tribulations for the inventor, as was ever the wont of such small malicious natures.

There will be those whose every endeavor will be to bring about contentions as to, we will say, steam consumption of this engine, claiming it to be excessive, or the other way, to the end, that the inventor lay bare the whole scheme of the motion, in order to demonstrate its meritorious features. The inventor would remind such that he is no newly born biped, that his eye teeth have been cut this many a day, that he is somewhat of a conniver himself, and that he intends to keep the salient features of his device sequestrated, against such time as the formation of a company to build this locomotive, and who are willing to "dig up" $1,267,348.27 in current coin and hand to your humble servant on a silver platter. Nay, kind friends, the explanation of this device we will pass by.

We will, however, venture this much information in relation to the reverse motion portion of this new system.

51 shows a bridge or carry-over, supported at either end by studs or pins. Equidistant on this bridge are round openings suitable for the reception of a movable crank pin.

When the desire to reverse the engine comes to the fireman, the locomotive is brought to a standstill, and a small iron ladder, carried on the tender, is placed on the ground, the top resting on the lower part of flange of the high driver 52. A dexterous twist of the wrist removes the crank pin from the position it is in, and it is moved along across the bridge to a corresponding hole on the opposite side, thus moving valves and reversing the engine. Talk about simplicity—this is simplicity itself!

52, 53, 54, 56, 57 pertain to sundry and divers driving and traction wheels, all designed to the one end—that of the highest speed, combined with a great economy and perfect safety. By the use of these traction and driving wheels great tractive power is obtained, the pull on the drawbar representing 213,647 pounds. Theoretically, this engine will easily haul 294 standard freight cars of 60,000 pounds capacity, fully loaded, at a speed of 84 miles an hour.

52, 53, 57 are tripod traction wheels, with "blind" or "bald" tires, mounted in such a manner as to produce a perfect balance of the reciprocating parts, and tends to make the smoothest running engine ever built—so smooth and noiseless, in fact, that, at a speed of 119 miles per hour, this engine will make no more noise in operation than a yellow tom cat crossing a wooden bridge.

58 is rear top frame bolted rigidly to firebox, and supported by coiled equalizing springs 62 on the lower rear frame 67, which is free from the firebox and attached to the running gear.

59, 60 have to do with a new grate-shaking device or shudderquake, of very refined adjustment, and worth alone the price of an ordinary locomotive. 60 is an idler wheel hung on a bell crank connecting with the cab by lever 74. This idler wheel being dropped down upon traction wheel 57, makes a contact with shudderquake 59, imparting a rotary motion to the same, moving a connecting rod and suitable rigging, and affording such shakes as may be required for the good of the engine. Drawings and patterns are preparing, whereby the product of this grate-shaking device may be utilized, which will tend to still further increase the savings at the coal pile.

61 is a hollow staybolt, with an opening of 1 inch in diameter. This serves to conduct atmosphere to the fire, and affords an escape for the oxygen-charged smoke returning to firebox through the carbowallop, should the engineer, through negligence or common, daily cussedness, fail to close petticoat pipe 43 and open by-pass 12.

66 is rear supporting wheel, 104 inches in diameter, for carrying the back end of engine and cab.

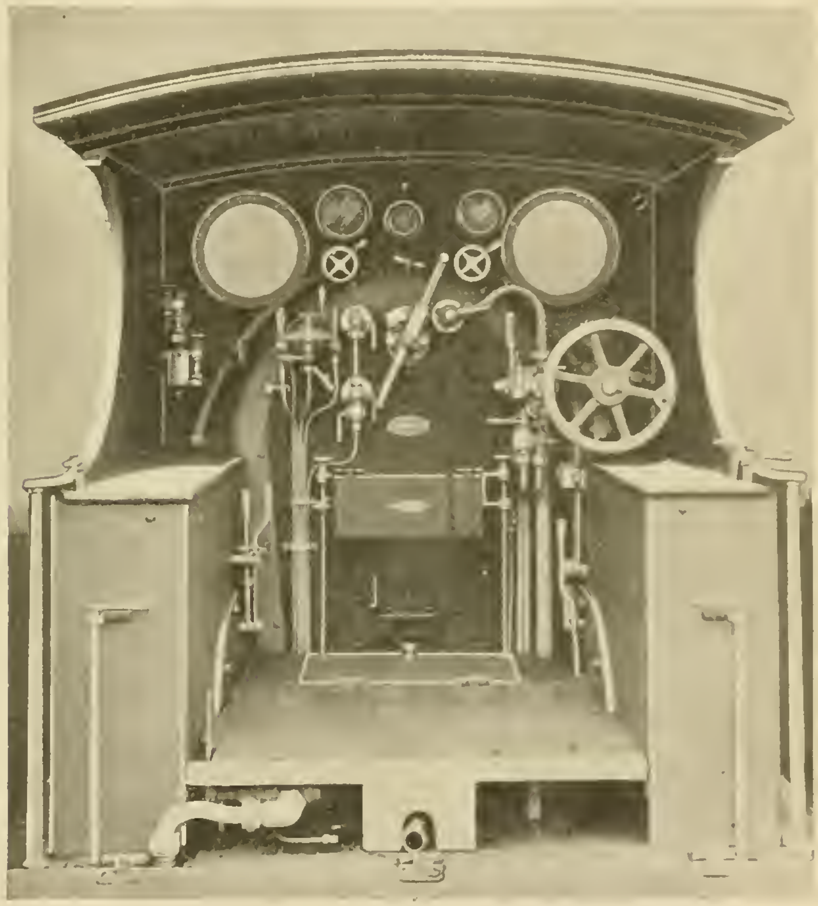
68 is an ashpan provided with a back damper or clean-out cover connected to cab by lever 69. In an improved device now making, the ashes will be conveyed to the tender, mixed with fresh fuel and burned over. This operation can be repeated until the ashes are worn out.

70, 71, 72, 73, is a new double duplex, wedge, push-down, driver brake. 70 is the brake shoe, composed of alternate strips of basswood, soaked in glue, and cast steel, and bearing upon an inner recessed portion of the back supporting wheel. 71 is a Damascus bronze wedge, attached to lower end of cylinder piston, and operates to force the brake shoes against wheel as shown, the brake shoes falling away from the wheel by gravity, when piston returns to cylinder 72.

This brake can be applied in less than 1-130 of a second, and is the improved brake referred to before, as being capable of bringing to a full stop in a distance of 8 feet, 10 inches, a train of 70 cars, at a speed of 42.7 miles per hour.

These quick stops open a new era in dividend getting, and are worthy of the most solemn consideration.

75 is just a common every week-day wind sheet.



CAB OF ENGLISH OIL-BURNING LOCOMOTIVE.

76 is a spring hanger.

77 is a polished steel hand hold charged with electricity by the calorifluke, so that in the event of the fireman's slipping when climbing into the cab, the act of slipping will turn on the electric current in the hand hold, preventing the fireman from falling, because of his inability to let go of the hold.

This is but a slight tribute to the high courage of the men who would dare to manage this engine, and at another time we may discuss some of the many pleasant features of this engine devised to make life more agreeable and worth the living to those up ahead.

78 is the water supply pipe to the injector.

79 is an electric cab step, especially designed for enginemen with large feet, and who wear heavy shoes. By standing upon the step and touching a small button, the engineman is swiftly shot into the cab without exertion on his part.

80 is bearing brace for brake shoe.

81, 85 pertain to the new and highly improved "Whale" injector, which automatically forces 96,378 pounds of water into the boiler hourly, delivering the cold water directly upon the crown sheet, which tends to keep the crown sheet cool and free from crimps.

82 is the nose of the running board.

83 shows gage or try cocks designed for left-handed firemen, and placed outside of the cab to prevent the dripping of water into the fireman's dinner pail.

84 is steam supply pipe to "Whale" injector.

86, 87, 91, 92 are portions of the cinder hopper or frugoeconomiter, and is a device for separating the coal and cinders coming through the carbowallop and delivering them on a shelf at the back end of fire box, where the fireman with a pair of asbestos mittens removes large rocks, bits of wire and scrap tin before returning the coal or cinders to the fire box. Should the frugoeconomiter become choked by material too large to pass through to the fire box, the fireman can remove the covers, 87, 91, and hit the conjested mass a t'ump with an eight-pound hammer provided for the purpose, thus starting the stuff in the direction intended by the inventor. This device exerts a coal saving of 25 per cent., which, combined with the saving effected by the carbowallop, makes a coal economy of 120 per cent. The improvements now making will result in these engines becoming coal producers instead of coal consumers, and doubtless the railroads adopting this locomotive will have coal for sale, or to give away.

88 is the steam dome, to which is attached the steam pressure gage, 89. One of the duties of the fireman is to arrive out on the running board every six or eight minutes, and keep "tabs" on the steam pressure, as exhibited on the gage —the object in placing the gage on the dome being to keep the fireman from sleeping and neglecting to remove the debris coming through the frugoeconomiter.

90 is the steam turret and throttle lever casing.

93 shows a brace for holding the steam hood of the car heating pipe.

94 is a brace from the steam dome to the frugoeconomiter, and acts to resist the impact of stones, coal and cinders coming through the frugoeconomiter.

95 is a double and triple silver-plated steam chime whistle of such power as to be heard, on a still day, at a distance of forty-three miles, giving the gatemen at crossings ample time to lower the gates and to warn passersby to stand at least 37 feet 6 inches away from the track when these fast trains pass.

96, 97 are portions of a new car-heating device. The steam escaping from the silver chime whistle is caught by the steam hood 96, and is carried back through pipe 97, which passes through the boiler to super-heat the steam, and thence to the car-heating system. This effects a saving of 100 per cent. in car-heating, the train being heated by steam that is usually lost or wasted at the whistle.

98 is a cab roof ventilator, which serves to clear the cab from smoke escaping through the hollow staybolts, due to overcharging the firebox by smoke returning through the carbowallop. Each locomotive is also supplied with a wet sponge, which the engineer can tie over his face to prevent suffocation, should the ventilator fail to clear the cab quickly enough.

99 is a signal lamp, similar in character to the one on the front of the engine.

100 is a cab bay-window, so arranged as to afford a clear view of the track ahead. This does away with the hole-in-the-elbow-wearing practice of leaning out of the cab window, prevents the cold air from blowing the engineer's eye out, or the dropping of equally cold rain water down the back of his neck.

101, 102 are parts of a very finely adjusted, quick-acting throttle, which is non-stickable.

103 is an electric nameplate, so arranged as to flash any number up to and including .99999, if for any good and sufficient reason these numbers can be used for any purpose whatever.

The foregoing explains, in a brief way, some of the many economical features of this new wonder in mechanics.

The inventor stands ready to demonstrate the economies of this engine, on any kind of paper, either with pen and ink or with a soft lead pencil with a rubber tip.

The writer has (in his mind) a great works for the building of these engines, and shops in which new methods for the economical handling of work obtains, and at some distant day may acquaint you with some money-saving devices which, to say the least, are startling.

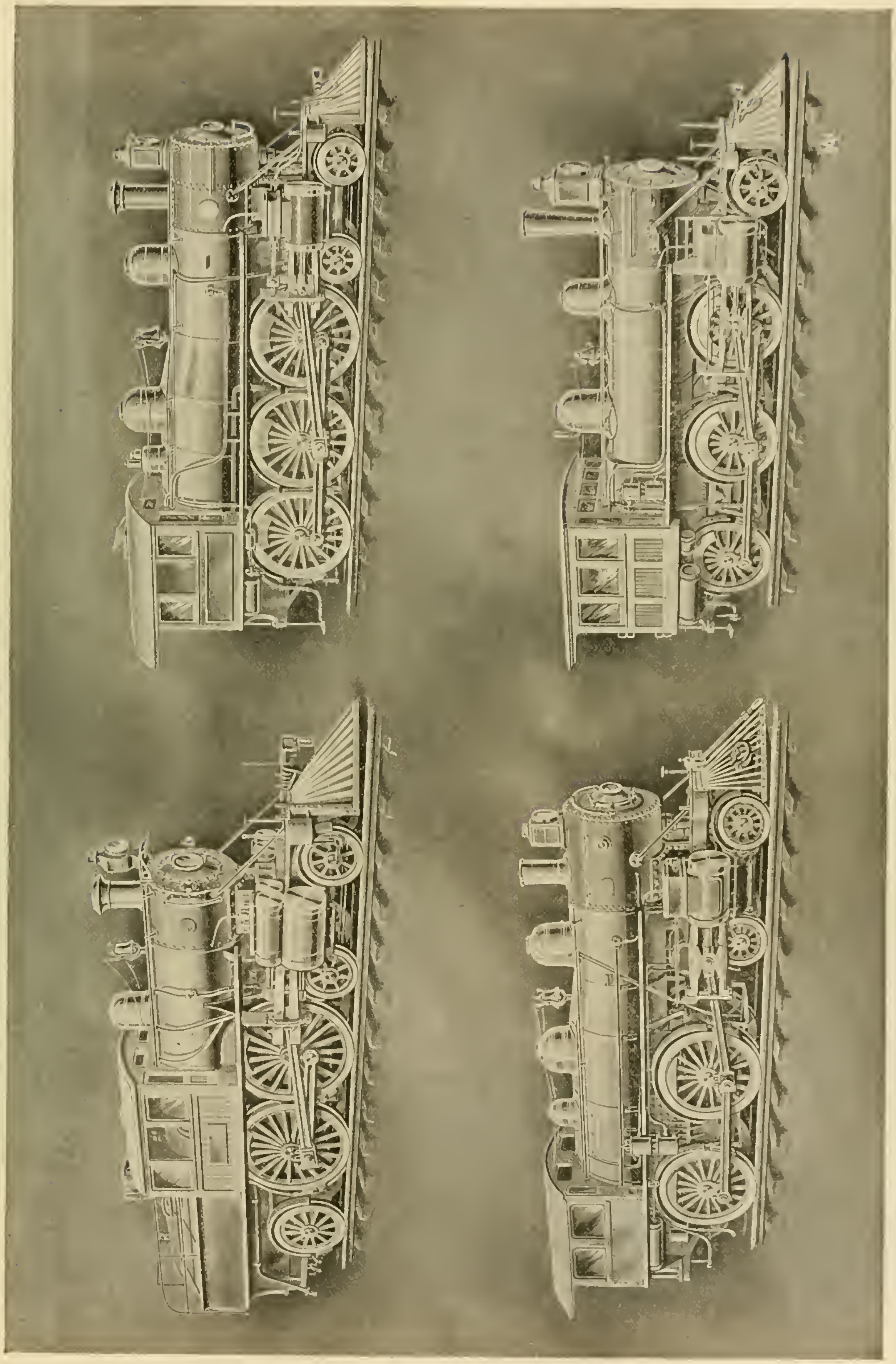
Improved Device for Threading Staybolts.

Railroad men have been made particularly familiar with the foundation defects of staybolts, due to the threads on both ends not being cut so that they will lead with corresponding turns in both sheets. Attention was drawn to this defect so vigorously by Jim Skeevers that numerous attempts have been made to devise a remedy different from that proposed by Skeevers, and the attention now directed to a serious source of weakness is likely to do a great deal of good. In this connection it is well worthy of mention that Mr. James Hartness, of Jones & Lamson Company, has proposed a scheme for cutting the staybolts so that no unequal strains shall be caused when they are screwed into place, which seems exceptionally good and practical. It consists of tandem dies for simultaneously threading the both ends of a staybolt, to insure an accurate correspondence in lead. His arrangement provides a means for accurately adjusting the relative longitudinal position of the dies, and the employment of some type of opening die of not too great length and not too inaccurate in lead, and possessing good diameter controlling features.

He says that both dies employed should be of the opening type, but the scheme would be equally as accurate if a solid or non-opening die were to be used in the place of the rear die. In fact, if the time consumed in operation were not to be taken into consideration, the front die could be non-opening and used to cut both ends, and in the place of the rear die a nut suitably mounted could be used.

It is not generally known, says the "Texas Railway News," that the famous North & South Railroad formerly had no telegraph wire. It runs a short distance in Southern Texas and has two trains. Recently these trains met midway. There was a great quarrel as to which train should back up to the end of the line. Finally the conductors agreed that the train having the less number of passengers should back up. The passengers were counted. One had nine, the other ten, and the train with the nine passengers backed to its starting point.

In tearing up a siding on the Straitsville division of the Baltimore & Ohio Railroad, the other day, the section men discovered that several of the rails had been made in 1863. Subsequent investigation revealed the fact that these rails were part of a lot that were bought in England during the war, at a cost of $125 per ton in gold. The rails were still in very fair condition, and for light motive power would last ten years longer.



GRAPHIC HISTORY OF THE LOCOMOTIVE.

Twelve Charts. Chart No. 12.

REPRESENTATIVE AMERICAN PASSENGER LOCOMOTIVES.

LOGGING IN WASHINGTON—THE OLD AND THE NEW POWER.

Logging Scenes in Washington.

In connection with the logging scenes shown, an esteemed correspondent in Washington writes us: "I send you a few photographs showing how logging is done in this section. These pictures do not show any especially large logs, but just those that are taken out here every day. Puget Sound logs are very large, as compared with Minnesota, Wisconsin and Michigan logs, and as a rule the logging roads out here are very substantially built and employ heavy engines and rolling stock, of which those shown are examples.

"Incidentally I might mention that the engine hauling the train on the trestle is a Pittsburg mogul, and the illustration shows only half of her train, the rest of the negative being too poor to print. It may not be out of place here to say that there are 410,333,335,000 feet of the finest merchantable timber in the world in Washington, and the trees grow from 200 to 400 feet high and 12 to 21 feet in diameter, and hundreds to the acre at that. One of these trees will furnish enough lumber to fill several ordinary box cars.

"I have taken 'Locomotive Engineering' since 1892, when I was 14 years old. I may have been your youngest subscriber at that time for all I know. I wish you would inquire through your columns if there are or were any younger, and I can testify to the merits of the paper by saying that I have not missed a single number since, although I am not in any business connected with a railroad and never expect to be."

THINNING THE FOREST PRIMEVAL.

William Willis, a driver for one of the local New York express companies, in handling baggage recently saw a package labeled "Handle with care." As this sign is usually put on asbestos packing, nails, rubber mats, frankfurters and other indestructibles, William went at it. He is in a hospital, with a fighting chance and a fancy that he is constantly dodging infernal machines. The box contained fireworks before William forgot to "handle with care."—"Expressman."

Early Opposition to American Railroads.

In the course of interesting notes on railroad history, Mr. John Kirby, the veteran master car builder, says:

"People reading the history of railroad development are often amazed to learn about the obstacles in the way of railway building, raised by the conservative people of England. A reader would suppose that English hunting squires, with a loving eye to protection of their game preserves, and sleepy village authorities of the same country, were the only people who did not at once perceive the advantages that would accrue to the communities from the extension of railways through their midst. No hint is ever given that any community on the American continent was ever so short-sighted as to object to the building of railroads. Yet there were short-sighted, conservative people living in American towns who could perceive nothing but disaster in the intrusion of railways within their borders. To go no further back than 1842, the citizens of Quincy, Massachusetts, had petitioned the legislature of that State for a charter to build a railroad to the southward. One of the surveys took in the town of Dorchester, which so incensed its inhabitants at the presumption of the leading business men of Quincy, for wishing to invade their peaceful hamlet, that the inhabitants held a meeting and appointed some of the most prominent citizens to oppose the passage of a railroad through their town. One of the resolutions passed 'declares it to be the opinion of the inhabitants of the town of Dorchester that a railroad built upon either of the lines designated by those asking for a charter will be of incalculable evil to the town generally, in addition to the immense sacrifice of private property which will also be involved, etc.' A second resolution declares that if, 'in spite of the protest of the inhabitants of Dorchester their town must be blighted by a railroad, it should be located upon the marshes and over creeks.'

"After the above mournful talk, they thought that the citizens of Quincy should be content with the then existing facilities for water transportation. 'What better and more durable communication can be had than the Neponset river or the wide Atlantic? By using these no thriving village will be destroyed, no enterprising mechanics ruined, no beautiful gardens and farms made desolate, and public or private interest most seriously affected. Many active, enterprising citizens may be found who have invested their all either in trade, mechanics, manufactures, or real estate, and all, all are sacrificed if a railroad is built through the town. Look at the interest, for instance, of the public house in this place, kept by a most estimable citizen, etc.' This house, with all the other property of the town, has shared that degree of prosperity that a railroad brings to most all towns.

The people of Dorchester were not alone in their narrow views of railroads. The same ideas prevailed along the shores of Lake Erie. The people of Western New York considered it the hight of folly to build a railroad to compete with lake navigation. Those people were not to blame for what they did not know. Even Chicago city officials in June, 1848, refused permission to enter the city with a railroad. Leave was, however, granted to lay a temporary track from the corner of Kinzie and Halsted streets to the North branch of the Chicago river, in order to transport a locomotive to the road. The streets named above were then the Western limits of the city."

On His Own Recommendation.

When J. W. Sherwood, now general superintendent of the Clover Leaf, was superintendent of the Big Four, he had to discharge a brakeman for violation of the rules. The man hung about the office asking for a letter of recommendation. To get rid of him, Mr. Sherwood told W. A. Sullivan, who was his chief clerk, to write the letter. This Mr. Sullivan did. The man went out and returned in a half hour.

"What's the matter now?" asked Mr. Sherwood.

"That letter you gave me is all right, isn't it?"

"Of course it is. That ought to get you a job anywhere."

"Well, I wish you would read this letter of recommendation I've got, Mr. Sherwood, and give me a job."

Sherwood took the letter on which his own name was written hardly dry, read it carefully and remarked:

"I am well acquainted with Sherwood, and anyone he recommends must be all right. You report to the trainmaster, and tell him to put you to work."—"Globe Democrat."

No Luxurious Traveling There.

"There is," writes a correspondent, "an air of perfect rural simplicity (in some respects) about the management of the Cape Government Railway. For instance, on Saturday afternoon, I journeyed by a Simon's Town train from Capetown in a first-class carriage. Doors of carriages were apparently scarce on Saturday, and one of the doors of the carriage in which I took my seat had been bodily removed. But we journeyed on, all the same, minus the door. Fortunately, the occupants of the carriage had good nerves, and were perfectly sober, so that all reached their destination in safety. Railway carriages without doors are novel and not unpleasant, so long as the passengers can get well back and hang on to the seat. True, there is a draught strong enough to carry off hats and all parcels less than half a hundredweight, but, by dint of watching and warding, that little difficulty can be overcome."—"Cape Times."

Aiding Adhesion.

The electrical adhesion chap is again getting in his work in the columns of the supposedly mechanical publication. It's the same old scheme of "holding her down" on the magnetic principle. The paper says:

"The locomotive carried a small dynamo, which furnished the current, and successfully pulled up a freight train of forty-eight cars. The distance was covered in one-half the usual time, no more coal being used than ordinarily, and the pressure of steam being the same."

This is akin to the Holman idea, in that it is expected to get there in half the time with the same coal and steam pressure, which means the same power. You can't fool Nature that way.

Electricity on Steam Roads.

Col. N. H. Heft, of the New York, New Haven & Hartford road, read a very interesting paper on the uses of electricity on roads now operated by steam, and referred to the Nantasket and New Britain branches, which they have equipped.

The Nantasket branch, with the overhead trolley, is said to be much less satisfactory than the third-rail system in use from Hartford to New Britain.

One interesting feature is the use of "sparks" as fuel in the plant at Berlin. The "sparks" are obtained from the front ends of locomotives, which cost them but 70 cents a ton, delivered.

In order to burn these, it is necessary to alter the furnace somewhat and to introduce live steam under the grates, which not only forms a blower, but provides a small supply of water. This being decomposed furnishes the oxygen and hydrogen gases, which increase and assist the combustion of the half-burned coal, and add much to the furnace heat. The ordinary grates are used without difficulty. While a greater weight of "sparks" is required to obtain the same results as with fresh coal, the balance remains in favor of the sparks.

A novel proposition was made not long ago to the receivers of the Baltimore & Ohio Railroad. The B. & O. has a branch running from what is known as Alexandria Junction, near Washington, to Shepherd's, on the Potomac River, where a car ferry is operated in connection with the lines leading south from the capital. A professor of an Eastern college desired to lease this short stretch of track for the purpose of educating young men in practical railroad work. In his letter he explained that he thought there was a wide field for bright and energetic boys who could be thoroughly well grounded in the practical side of railroading, provided they could be educated on a regular line of road. He believed that by the employment of veteran railroad men as teachers, that the boys could profitably spend two or three years working as trainmen, firemen, engineers, switchmen, station agents, and in other capacities required in the railroad service. As this branch of the B. & O. is of considerable value, the receivers were compelled to decline the offer.

Work is so active in the shops of the Atchison, Topeka & Santa Fé, at Topeka, that the blacksmiths are working till 10 o'clock three nights of the week.

LOGGING IN WASHINGTON—ON THE WAY TO THE MILL.

Air-Brake Department.

CONDUCTED BY F. M. NELLIS.

Air-Brake Pressure Recorder Card.

The accompanying record of air brake pressure was taken by Mr. H. C. Frazer, the W. A. B. Co. expert, at San Francisco, California, and is from a local passenger train on the Southern Pacific Railway, engine 1503, Engineer Frick, Oakland Pier to Fruitvale and return.

The machine which takes the cards is attached to the train pipe, and is a simple clock arrangement which moves the paper along in a horizontal direction at the rate of one foot per hour, or one inch each five minutes. The pencil is moved vertically up or down on the paper according as the pressure in the train pipe is reduced or increased. These two movements trace the record line. The perpendicular lines represent time intervals of one minute each, the rate of travel of the paper being one foot per hour. The horizontal parallel lines represent pressures which are indicated by the figures at the left. Knowing this, the card may be easily read.

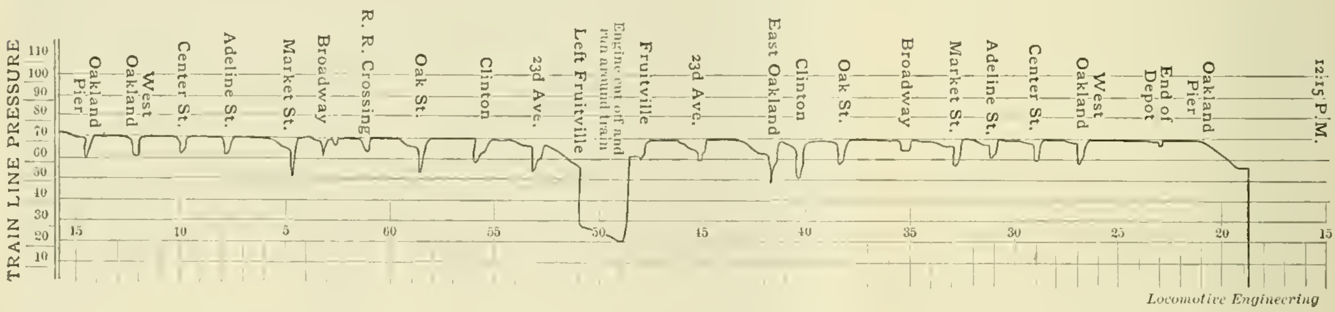
this retardation drifted into the station for about ten or fifteen seconds, when a final reduction of about 2 pounds was made to complete the stop, about 12 pounds in all being made. The release was made through the running position. The pressure rose almost instantly from 58 pounds to 67, where the feed valve attachment began to close, causing the last 3 pounds of charge to take about a minute.

One and a half minutes later, the stop at Center street was made. The time on this run is evidently fast, or possibly Center street is a difficult stop to make, for the diagram shows that one continuous 9 pound reduction was made. The release was identical with that at West Oakland.

At 12.31 the stop at Adeline street, similar to that at West Oakland, was made. The release was also similar. However, there is a slight difference in the release line after the feed into the auxiliaries begins.

engine was cut off and run around the train. Just what happened at Fruitvale is somewhat problematical, and beyond our ability as a clairvoyant to tell. But whatever was done was done quickly, for the diagram shows that five minutes after the beginning of the stop at Fruitvale, the stop at Twenty-third avenue, on the return trip, was begun. In this time the train had been brought from speed to a standstill, engine cut off, and run around the train, passengers discharged and taken on, and run made to Twenty-third avenue. Possibly the recorder was thrown out of gear during the stop at Fruitvale in order to save recording paper. In this event, our remarks at this point would not apply.

The return trip to Oakland Pier ended at 1.15. The diagram shows the additional interesting facts that at Clinton the application was begun farther away from the station than any of the preceding ones and that two applications were made at Broadway.



AIR-BRAKE INDICATOR CARD TAKEN BY A PRESSURE RECORDER.

An analysis of the card is interesting. Reading from right to left we learn that at about 12.19 P. M. the engine coupled up to the train and the air in the train pipe rose instantly to about 56 pounds. For about one-half minute the feed into the train pipe was about equal to that taken out by the auxiliaries. Then the pressure rose gradually during the next two minutes to 70 pounds. At about 12.23, as the train was leaving the depot, a train pipe reduction of 4 pounds was made, possibly to slow up for switches, but more probably to make a running test of brakes, as no other test was made after the engine coupled onto the train. The brakes, thus applied, were held on about ten seconds, and then released through running position. In less than one minute the pressure in train pipe and auxiliaries was again at 70 pounds.

The next use of brakes was at 12.26:30, in making the stop at West Oakland. An initial reduction of about 4 pounds was made, followed in quick succession by other light ones. Then the train under

The stop at Broadway at 12.35, was more easily made for some reason (probably a slower speed or rising grade), where only 6 pounds was used. The stop here was longer than those at preceding stations, probably on account of this being a busier thoroughfare, and more passengers to be discharged and taken on. About 30 seconds were consumed, and brakes were held on during the entire time.

The stop at Oak street, made at 12.38:-20, was similar to those at West Oakland, Adeline street, and Market street.

At Clinton, at 12.40, the stop required a 20 pound reduction.

At East Oakland, a minute and a half later, a similar stop was made. These two last stops were doubtless made from high speeds or on falling grades, as heavier reductions were necessary.

The stop at Twenty-third avenue, at 12.45, was made with about 12 pounds, and was, presumably, an easy stop to make.

The run ended at Fruitvale, where the

Withal, the record is a remarkably good one. The small amount of air used speaks eloquently of the good condition of brakes in the train and the skill and judgment of the engineer.

We have another card taken from another local train, engine 1507, Engineer Clark, but do not publish it, as it is so similar to the one just discussed.

It is rarely necessary to tell an air-brake man whether the road he is traveling over has an air brake instructor. When passenger trains come to a stop without putting a kink in everybody's neck, and stops at water tanks are made with a service application, it is pretty safe to assume that there is somebody paid for attending to air-brake matters on that road.

Air Whistle for Caboose.

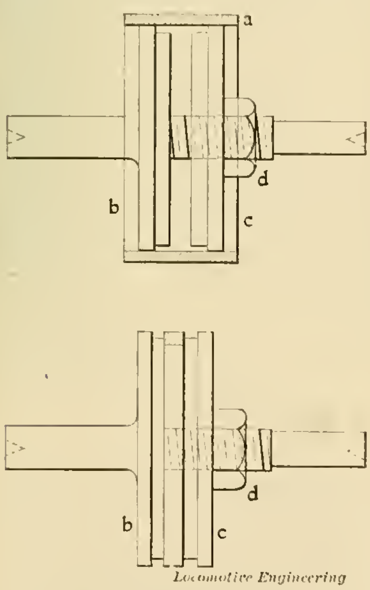
A recent patent has been granted for a pneumatic device whereby the train men in the caboose may signal the engineer in foggy weather. As shown by the accompanying cut, the device consists of a cylinder and piston, located at any convenient place in the caboose. By pulling the cord the piston is forced upwards, and the air in the cylinder is thereby compressed and forced through a pipe to the whistle outside. This produces a sound which the engineer is supposed to hear. Upon releasing the cord a spring forces the piston down. The piston is supplied with flap valves, like the ordinary single-acting bicycle pump, which open as the piston descends and allow the cylinder to fill with air for the next blast. Further information regarding the device may be had by writing John W. Graham, Albert street, Thirty-second ward, Pittsburg, Pennsylvania.

Mandrel for Turning Cylinder Packing.

The attached sketch is taken from the Air Brake Men's 1897 proceedings, and illustrates a device introduced on the L. & N. R. R. by Mr. Robert Burgess. The object of the device is to turn packing rings to the proper size, and fit them to the cylinder without filing.

The inside of the ring is bored to the standard size and left plenty large on the outside to fit two sizes of cylinders (a standard cylinder and one that has been rebored). It is then cut and the end fitted to butt together when sprung into former *a*. While in former *a* it is clamped solid betwen mandrel *b* and its washer *c* by the nut *d*. The former is then removed and the packing turned to fit cylinder.

Usually the rings are turned slightly larger in diameter than the bore of the cylinder. Then they are sawed and fitted with a file to the cylinder. In using this method, the rings ofttimes bear only on the two points and the point opposite, and blow almost as badly as the old rings. Rings fitted on the above plan will have a good bearing right from the start. The plan is a good one, and should be adopted with profit by all pump repairers.



PACKING RING MANDREL.

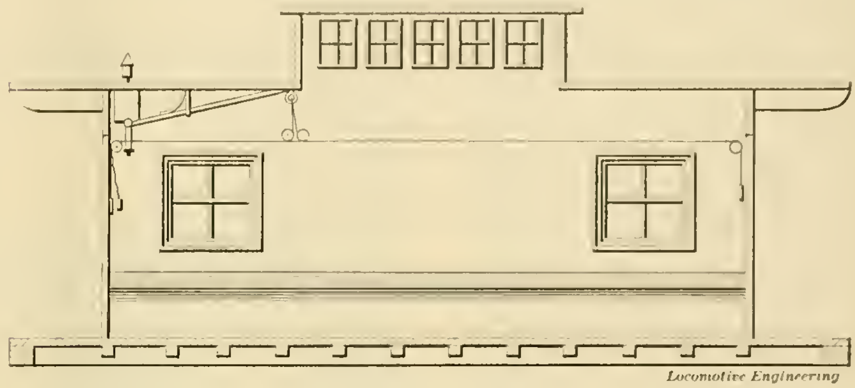
Increased Brake Efficiency.

Perhaps the most entertaining and instructive paper recently read before any of the railway clubs and conventions, is that on "The Effect of Brake-Beam Hanging Upon Brake Efficiency," read by Mr. R. A. Parke, before the November meeting of the New York Railroad Club.

This paper is by far of greater interest to air brake men in particular, and railroad men in general, than anything brought out in the air brake line since the introduction of the high speed brake, by which the length of stop has been reduced 30 per cent. over that of the best brake.

Mr. Parke proposes, with his plan, to still further shorten the distance by 15 per cent. His method is simple in application, and consists in using a longer brake shoe hanger, to which is given a certain calculated angle to the tangent line where the brake shoe touches the tread of the wheel. Mr. Parke has, by logical reasoning, assigned a special angle to the shoe hanger and a special position to the brake shoe, instead of the angles and position heretofore given by the rule of thumb. That this method will do that which is claimed for it is proved by actual demonstration. Cars equipped with brakes in accordance with these precautions, have actually been stopped in 15 per cent. shorter distance than when the ordinary locations were given the brake shoe and hanger.

The paper is quite lengthy and treats the subject in minute detail, and we are therefore unable to present it here at this time. Next month, however, we will publish such portions as will make its purpose clear to our readers.



AIR WHISTLE FOR CABOOSE.

An Unusual Forethought.

An inventor writes us asking what requirements must be met by a triple valve which he has in course of construction, in order that it may pass the M. C. B. tests. The novelty of this inquiry is striking. So few inventors ever stop to think how necessary it is that their devices must work harmoniously with other devices already in use. They go blindly on inventing, without ever giving a thought to anything but the development of their device. After it is finished, they wake up to the realization that it would have been much more profitable had they considered certain important matters earlier in the process. Then, because they can find no sale for their invention, they feel that wrong and injustice has been done them. They find sympathizers, however, who declare the device is cheaper and superior to all others, but sympathy and opinion alone will not pay patent office and attorney's fees.

The air brake recorder card bids fair to become an important adjunct in perfecting air brake operation. In many instances poor stops are made, not because of lack of knowledge, but, instead, is the failure of the engineer to apply the knowledge and skill which he really possesses. The indicator card tells in the engineer's own hand writing just what he is doing, and may be used as a means of strengthening him in parts wherein he is weak.

There are two essential things to be observed in handling air-braked trains that are contrary to practices that were common and proper before the introduction of air brakes. These are as follows: Never reverse the engine when air brakes are applied, for flat driving wheel tires will surely result if the engine brakes are any good. When the train breaks in two between air braked cars, shut off steam instantly, and don't attempt to pull forward section clear of rear section, for such attempt will meet with failure almost invariably, and a collision of the two sections will result.

CORRESPONDENCE.

An Automatic Retaining Valve.

Editors:

Owing to the leakage between the triple valve and brake cylinder, particularly in the packing or piston leather after it had become dry or worn in the cylinder, it became necessary for us to improve our automatic retaining valve (a cut of which appeared in April issue of "Locomotive Engineering") so that it would take up this leakage and retain the desired pressure substantially in the cylinder. This valve can be operated either with the triple or independent of it. It can be applied or released by the engineer's brake valve with as low as twenty pounds main reservoir pressure. It is operated as follows:

With the brake valve in running position, air accumulating in train pipe *E* feeds through small valve G_4 and the openings G_1 into chamber G_2, which is the train line side of piston *H*. At the same time it feeds through triple *A* to auxiliary reservoir *B* and connection *F* to chamber *X*, or auxiliary reservoir side of piston *H*, thus equalizing pressure on the two sides of the piston. Any excess would be equalized by leakage port *J* in piston.

Upon a reduction of air in train pipe, the pressure is decreased in chamber G_2 by way of valve *N*, as seen in Fig. 2, causing the excess in chamber *X* to force piston *H* forward until it engages stop *I* on cap, as seen in Fig. 1.

The stem of piston *H* carries the slide valve *L* to the position shown, lapping port *R* from the atmosphere. To release the triple valve, leaving the retaining valve applied, the brake valve is placed in running position and causes a slow release of the triples. The tension of the spring on valve G_3 being great enough to resist a feed release. The triples now exhaust the cylinder from *D*, pressure passing through chamber *S*, port *R*, valve R_1, and port R_2 to the atmosphere, the spring on valve R_1 closing the valve R_1 when the pressure is reached which it is desired to retain.

T is a diaphragm, located in chamber *S*, so that if leakage should now occur in the cylinder and reduce the pressure there, it would also reduce it in chamber *S* below diaphragm *T*, the spring of which is set at a tension slightly below that on the retaining valve R_1, and would now cause the diaphragm to move downward covering the stem valve *U*, opening communication with auxiliary reservoir pressure by way of port *O*, by port *Q* and port *R* to the cylinder. Once the pressure is fed up in cylinder and chamber *S*, it forces the diaphragm upward, closing the valve, repeating its action each time leakage occurs, taking it up pound for pound, thus retaining the pressure substantially in the cylinder.

The full release forces open the valve G_3, and creates an excess pressure on chamber G_2, or train line side of piston *H*, and forces the piston back to the wall of chamber *X*, and the slide valve *L* to open communication between ports *P* and *R* by port *Y* in slide valve, which allows all brake cylinder pressure to exhaust to the atmosphere. At the same time the slide valve laps port *O* and cuts off auxiliary reservoir pressure from both retaining valve and cylinder. We claim this device saves air by making repeated applications of the brakes on grades unnecessary, enabling enginemen to keep their auxiliaries fed up for emergency and to relieve the trainmen of an unpleasant duty.

STARRETT & WELSH.

Wilmerding, Pa.

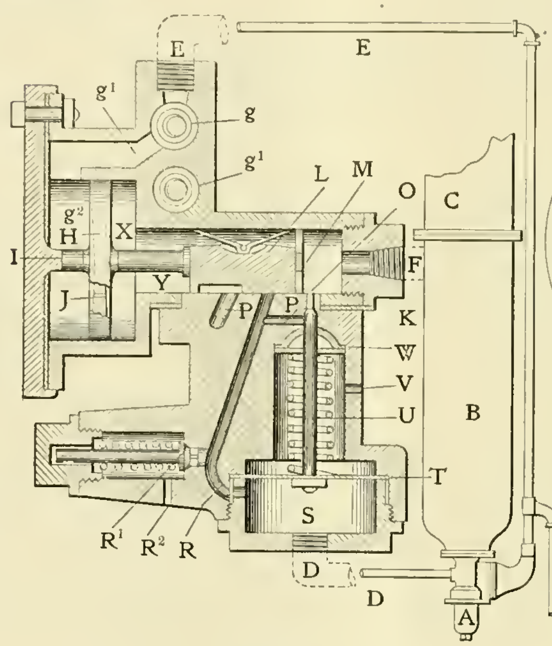


Fig. 1

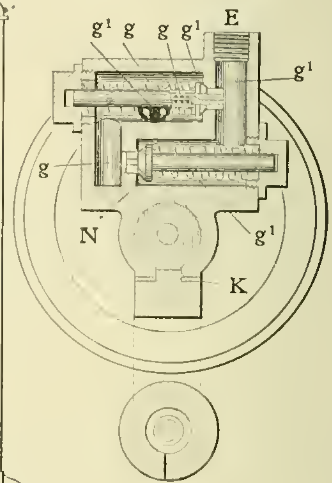


Fig. 2

Locomotive Engineering

AN AUTOMATIC RETAINING VALVE.

The High-Speed Brake for General Use.

Editors:

July number has an interesting article with illustrations of the Westinghouse High Speed Brake. Now, I would like to ask the air brake experts if they can give any good reasons why the high speed brake should not be adopted for all trains, both freight and passenger, as it is only necessary to add the cylinder pressure reducing valves to the quick action brake to convert it into a high speed brake The expense and time required would not cut much of a figure.

The article referred to above says: "On account of the high pressure normally carried in the auxiliary reservoirs (110 pounds), a full service application of the brakes (charging the brake cylinders with air to 60 pounds) may be made, and still leave the pressure in the auxiliary reservoirs at nearly 100 pounds. If, after releasing the brakes, a second application of the brakes should be called for before there had been time to recharge the reservoirs, there is abundant air yet stored in the reservoirs to make a second, and even a third, full service application, and still have sufficient air pressure to make an emergency stop equal to the ordinary quick action brake." Now, right here is one feature of the High Speed Brake that would knock out all the schemes so far devised for recharging auxiliaries while brakes are applied.

It might be a good idea to pipe exhaust port of one of the cylinder reducing valves and run it into cab and attach a whistle, so that whenever engineer made too heavy a reduction of service application, he would receive a warning. The air gage should be placed convenient to the engineer. He could and should then cultivate the habit of braking by the gage.

If the high speed brake is a good thing for the Empire State Express, it would, for the same reason, be good for all other trains. There are many local trains that run as fast as the "flyers." Of course they don't show up on time card as being as fast for the reason that the stops are more frequent. If you should have a call for the emergency you might want to stop just as bad as though you were pulling the "flyer." Many a wreck has happened that could have been avoided had the engineer been able to stop a few car lengths sooner.

ORANGE POUND,
Engineer S. F. & W. Ry.

Bartow, Fla.

Warning Appliances for Air Brakes.

Editors:

The recent accident on one of the big roads in this section in which the engineer lost his life, and in which investigation proves there was little or no air in the train pipe and auxiliaries with which to make the stop, has again brought up the need of warning appliances to call the engineer's attention to the fact that his pressure has fallen below the safety limit. No doubt some of the readers of "Locomotive Engineering," and others as well, are now designing some appliance of this kind.

Now, while I am generally opposed to these so-called warning appliances, and, if I had my way, would remove from the air brake system all alien attachments, such as water-raising systems on sleeping cars, etc., yet I will make an exception in this case, and hasten to offer an effective warning device, not only for detecting falling pressures, but one which will detect almost anything that may befall the air brake, and thereby tend to lessen or destroy the efficiency of that greatest safety device ever invented.

My scheme is simple, and is not patented. I may be ridiculed for advocating that which may seem so simple a thing to persons in some departments of railroad work, and yet I am convinced that many engineers and air brake men throughout the country will agree with me that if my scheme were adopted, much money would be saved to railroad companies, and the safe operation of trains would be greatly enhanced. The device I would use is an old one. The use I would make of the device, however, is a new one. The device in the ordinary duplex air gage, which, in many instances, has "hanging room only" in the locomotive cab. The use I would make of the gage is to place it where it can be consulted by the engineer both at night and in the day time. That is my scheme, complete. I do not claim invention, nor even priority of conception, for the scheme is an old one, and is one which has been much undervalued by locomotive builders and shop men.

Bob Michaels' "Kicker" in November number tells a true story when he says that the air gage is usually put up where nobody but the apprentice boy who located it could find it without the aid of a torch.

How many air gages are placed on the fireman's side? How many others are located four or five feet away from the engineer? How many more are rolled around from 20 to 90 degrees, making the figures 90 and 70 stand anywhere but on top where they ought to stand? And still further, how many gages have such dirty faces that you can't tell a 3 pound reduction from a 10? Surely it would pay to give the gage a better location, and to keep it in good condition.

A true safety warning device is not a whistle which will call the engineer's attention when the pressure falls below the safety limit, but, instead, is something that will keep him in touch with his work. Something which he may counsel, and from which he may seek advice. The air gage is this counsellor and advisor, if it is permitted to perform its function, but if it is packed off in some isolated position, so as to be unavailable, it ceases to be an advisor. Bring it down where it can be seen, even though an additional cab light be required to see it at night, and you will have a warning device better than a whistle or anything of that sort. This is my safety device with which I propose to save money to railroad companies, and increase the efficiency of air brakes. What do you think of it?

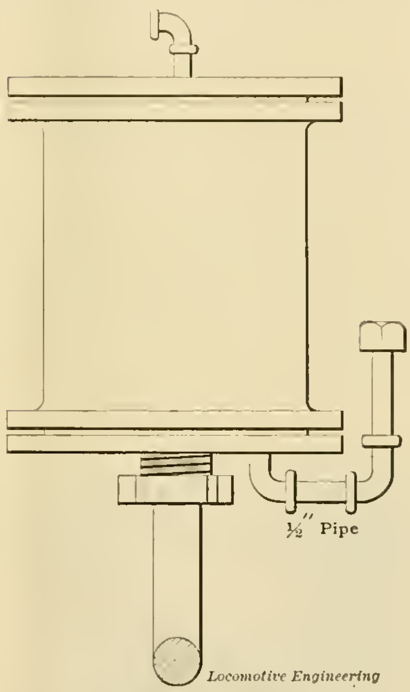
Amos Judd.

Boston, Mass.

Oiling Device for Pull-Up Cylinder.

Editors:

I submit the accompanying sketch of a convenient method of getting a little oil on the pressure side of the pull-up driver brake cylinders. A heavy oil should be used, but made quite warm before using, so as to run freely. Thin oil should not be used, as it will work out through the triple. Not over 3 ounces should be put in each cylinder at a time.



A CYLINDER OILER.

Ralph E. State,
Big Four Railway.

Bellefontaine, O.

Necessity for Considering Atmospheric Pressure in Compressed Air Computations.

Editors:

While Mr. Kelly, of the New England R. R., is figuring on the number of cubic inches of air that goes from the auxiliary into the brake cylinder, and the resultant pressures on equalization, here is an example that will help to show why we start at the vacuum line to calculate the pressures; that is, 70 pounds on the gage must have 15 pounds added to it to get the full amount.

In case the piston in an 8-inch brake cylinder is blocked out at the point of 8-inch travel so it can move neither way when the brake is set and released, will it take more or less air from the auxiliary than if it is free to move out eight inches and return to end of cylinder when released, using a full service application in each case? As the leakage groove will be covered in one case and open in the other, we will consider there is no leakage groove in the cylinder to use any of the air before the piston covers it.

Of course it will be readily seen that when the piston is blocked out, the cylinder is full of air at atmospheric pressure. When the piston moves out the eight inches it leaves a space that, as far as the auxiliary is concerned, is a perfect vacuum, and the cylinder, with moving piston, will take 402 cubic inches of air at 15 pounds pressure, that the cylinder with blocked out piston does not need.

Clinton B. Conger.

Grand Rapids, Mich.

Regarding a Leaky Graduating Valve.

Editors:

In your comment on remarks by L. W. Tighe, under the heading "An Experience with a Releasing Driver Brake," you say that a leaky graduating valve, unless aided by a leaky slide valve, or its seat, cannot cause the triple to go to release position. Will you please say what would be the result with a leaky graduating valve, if a reduction was made in the train line of, say, 5 pounds, and the slide valve and its seat were perfectly tight?

Perhaps I do not understand the position taken by yourself, but it looks to me as if with a 5-pound reduction in train line, which would give about 12 pounds in the brake cylinder and still leave 55 pounds in the auxiliaries, that there would be a feed through the leaky graduating valve to the brake cylinder, thus reducing the auxiliary pressure below the train line, and cause the piston to go to a full release position. This would seem to take place as often as a reduction was made in train line which would not be sufficient to equalize auxiliary and brake cylinder pressure.

You also state that if a leaky graduating valve were to start a triple towards release position, that it would stop, unless aided by a leaky slide valve or its seat, as soon as the port in the face of the slide valve is blanked. As it is the excess of train pipe pressure which forces the piston to release position, I cannot see why it should stop when the slide valve has moved the distance mentioned. I fail to see any difference in the effect of reducing the auxiliary pressure below the train-line pressure or increasing the train-line pressure above auxiliary. In either case the result is to force the piston to release position, unless when auxiliary pressure has been reduced enough to start the piston back, it is again increased to make it balance with train-pipe pressure, which I think would be a very improbable condition.

ALONZO G. KENYON,
Engineer C. M. & St. P. Ry.
Elgin, Ill.

[If a 5-pound reduction were made, the triple piston and slide valve would go to service position, and auxiliary pressure would feed through the graduating port to the brake cylinder. This feed would continue until the train pipe and auxiliary pressures equalized; then the piston would seat the graduating valve in the slide valve, and shut off further feed. At this point train pipe and auxiliary pressures are equalized and if there were absolutely no leakage of either pressure, the triple piston and its parts would remain in this position indefinitely. However, should all parts be positively tight, except the graduating valve, there would be a slight feed from the auxiliary reservoir to the brake cylinder, even after the graduating valve became seated. This leakage feed would in time reduce the auxiliary pressure sufficiently below that in the train line, to cause the triple to move toward release position, and, as soon as the port in the slide valve broke connection with the cylinder port, the auxiliary pressure would cease to reduce. To get to position where brake cylinder pressure could escape to the atmosphere (which is about 3-32 inch further on) the piston would actually have to compress the air in the auxiliary. However, should the slide valve leak, the parts would gradually work from lap to full release position.

In this discussion we have assumed that there was no friction of the parts, and that movement is controlled entirely by slightly differential pressures. Of course there is always a little friction, even in well lubricated triples, but not sufficient to change the above results.

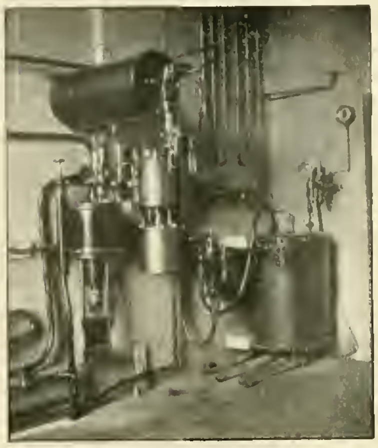
Should the working surfaces be dirty, and gummy, the friction might be so great as to require a 5-pound reduction to pull the parts loose. Then, instead of stopping in service position, they would go to emergency. Should they stop in service position, they might stick there until the auxiliary had reduced four or five pounds below train line, and when they broke loose, would go to full release position.—ED.]

Port Morris Instruction Room.

Editors:

Through the progressiveness of Division Master Mechanic Lewis, and General Air Brake Inspector McKenna, we have been given a neat air brake instruction plant at this point. I send you photographs for publication. We have no testing and repair plant yet, but probably will have one soon.

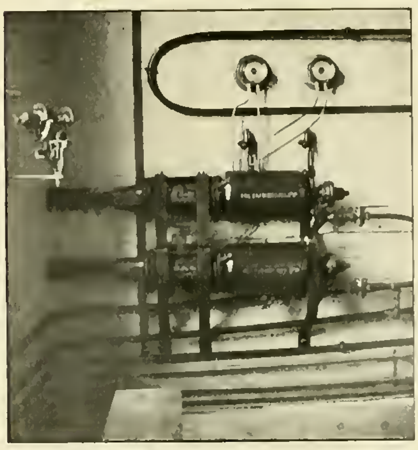
This room is used for instruction purposes only.



D., L. & W. RY. AIR-BRAKE ROOM, PORT MORRIS, N. J.

It is fitted with an 8-inch pump, main reservoir, D-5 brake valve, driver brake, a plain sectional triple operated by another plain triple, sectional quick action triple and brake valve, and three freight brakes, complete, with piping, etc. All the pressures are connected up to duplex gages. There is also the signal apparatus, working and in section, so that it can be easily understood. The plant, while small, is doing good work, and we think it is a good investment.

J. A. ALPAUGH,
A. B. Instructor.
Port Morris, N. J.



D., L. & W. RY. AIR-BRAKE ROOM, PORT MORRIS, N. J.

More About Compressed Air.

Editors:

In September number, question 105, a writer asks will an auxiliary charged with 50 lbs. pressure put as much pressure in the brake cylinder by making a 10-pound reduction in the train-pipe as an auxiliary charged with 70 pounds pressure will. A says it will, and B says it will not. The answer says A is right. According to my opinion B is nearer right than A, for the following reasons in figures:

Formula: $p_1 = \frac{p\ v}{v_1}$ where p = the original pressure, p_1 = final pressure, v = volume corresponding to the pressure p, and v_1 = volume corresponding to the pressure p_1.

Taking a 10 x 24-inch auxiliary reservoir and an 8-inch brake cylinder with 7-inch piston travel in both cases, $10 \times 10 = 100 \times .7854 = 78.54 \times 24 = 1884.96$ cubic inches contents. The brake-cylinder, 8-inch diameter and 7-inch travel, would contain $8 \times 8 = 64 \times .7854 = 50.2656 \times 7 = 351.8592$ cubic inches, omitting the contents of the triple valve and small pipe used for connecting. In the first case, $1884.96 \times 50 = 94248. \div 2236.82 = 42.135$ pounds pressure in the brake cylinder. In the second case, $1884.96 \times 70 = 131947.2 \div 2236.82 = 59.00$ pounds pressure in cylinder. Therefore, the drop in pressure from 50 to 42.135 would be 7.865 pounds, while the drop in pressure from 70 to 59 would be 11 pounds, which would make B nearer right than A, by the difference which would be 3.135 pounds.

J. A. BRETH,
Fireman, P. R. R.
Grant, Pa.

[Our correspondent has fallen into the same error as Mr. Kelly in October number, viz., in using gage pressures instead of absolute pressures. Secondly, the method employed (were absolute pressures considered instead of gage pressures) would give the ultimate pressures in the brake cylinders after auxiliary and brake cylinder had equalized, but would be useless to prove what the writer sets out to prove.

That A is right will be apparent with a little reasoning. If we take a vessel whose cubical capacity is one foot, and pump into it until we have one pound pressure (gage pressure), a certain measure of air will have passed into the vessel. If we wish to raise the pressure to two pounds, another measure must be pumped in. If to three pounds, another measure, etc. In other words, the same measure of free air is required to raise the pressure one pound, no matter whether that pound be taken down near zero or up higher. This measure is constant. Conversely, if we wish to reduce the pressure in the vessel one pound, one measure of free air must be drawn out. Likewise we can change our scale to ten pounds, and the measure is still constant. Hence the result. The experiment is interesting and should be tried.—ED.]

A correspondent asks: "What has become of Jake Baker and Danny Dugan, and is not the former nearly in condition to take his next degree?" Those parties are hereby notified.

QUESTIONS AND ANSWERS

On Air Brake Subjects.

(141) J. O'N., Jersey City, N. J., writes: Have been interested in your "Doctor Standard" story of the air-brake trials. Is there any published record giving full results of those tests, that can be obtained now? A.—Write J. W. Cloud, Secretary M. C. B. Association, 974 Rookery Building, Chicago, Ill., who will give the desired information.

(142) W. W. M., Bloomington, Ill., asks: 1. How much larger should the packing ring in an 8-inch or 9½-inch air pump be turned than the bore of the cylinder? A.—1. See article, with illustration, on this subject elsewhere in this department. 2. Should there be any difference between the packing for the steam cylinder and air cylinder, relative to the expansion of the rings? A.—2. No.

(143) C. B. B., Jersey City, N. J., asks: How much clearance is there at end of stroke in the 6-inch, 8-inch, 9½-inch pumps? A.—All these pumps are designed to have no clearance. When steam is first turned on, the piston will strike the heads; but as air pressure is accumulated, the pump takes on a very little clearance, as is shown by its smooth working. One of the important considerations in designing air pumps and air compressors is, to have the least possible clearance.

(144) R. M., Jersey city Heights, N. J., asks:

Why does badly worn valve motion cause a slow up-stroke? A.—If the valve motion is badly worn, it is safe to assume that the main piston rings and other parts are also badly worn, and would cause a great waste of steam. The up stroke (and especially when the steam and air pressures more nearly approach each other) would naturally be slower on account of the weight of the piston hindering, where on the downward stroke it would assist.

(145) C. W. K., Toledo, O., writes:

I observe a port in the D-8 brake valve which connects the main reservoir pressure with the equalizing reservoir when the valve handle is in the emergency position. What is this port for? A.—In this valve there is a point about midway between service and extreme emergency position where, unintentionally, feed port *j* in the rotary valve coincides with equalizing port *g* in the rotary seat, and connection is thereby made between the main reservoir and chamber *D*. This does no harm, and would not be noticed except when handle is stopped on this particular point.

(146) J. O'N., Jersey City, N. J., writes:

It is said the preliminary exhaust ports are of a size that prevents emergency action on a one car train. What prevents it on the engine and tender alone? Are the graduating springs stronger in a plain triple than in a quick action? If not, I do not understand why a reduction which is just slow enough to prevent quick action on a one car train would not be quick enough to cause emergency on engine alone. A.—The port connecting the auxiliary reservoir and brake cylinder is larger in the plain triple than that in the quick action triple, and, consequently, permits a more rapid reduction in the auxiliary reservoir.

(147) J. J. McD., Syracuse, N. Y., writes:

I am working on an improved triple valve for air-brake use. The principle employed is new. I have been informed that, to be acceptable to railroads, the valve must stand the test adopted by the Master Car Builders' Association in 1894 for air-brake triples. As I do not know how to find what these requirements are, I write you for the information. A.—Your precaution is certainly a sensible one, and worthy of adoption by other patentees. The M. C. B. code for testing triple valves is too lengthy to present here. Procure a copy of the "Air-Brake Men's 1897 Proceedings." The code covers six pages, beginning on page 161.

(148) R. Q., Marshalltown, Iowa, asks: 1. How much larger should pump-packing rings be made than the cylinders? A.—1. See article and illustration bearing on this subject elsewhere in this department. 2. I claim that putting water in driver-brake cylinder is a bad practice and dries up the leather quicker than if nothing was put in. Am I right A.—2. You are. Read "The Kicker," by Bob Michaels, in November number. 3. What does "B. W. S.," in question 126 of November number, mean by two trains being equipped with 5 and 2 atmospheres, respectively? A.—3. Trains whose brakes are operated with absolute pressures of 73.5 pounds and 29.4 pounds, respectively, or gage pressures of 58.8 pounds and 14.7 pounds, respectively.

(149) B. W., Port Jervis, N. J., writes: Recently saw it stated in one of the railroad magazines that the smallness of hole through the little exhaust elbow (angle fitting, I believe it is called) was to act as a check on flow of air from train pipe. Is it not more properly the duty of the small teat on equalizing piston stem? A.—It was originally intended that the teat should be the restriction to the flow of air from the train pipe to the atmosphere in a service application, but there have been some few cases where the hole in the angle fitting was smaller than the passageway around the teat, and, consequently, in those cases, the restriction was in the fitting instead of at the teat. However, the function of the fitting is to conduct the train-pipe exhaust in a convenient direction, and not to furnish the restriction.

(150) B. W., Port Jervis, N. J., writes: I am using a D-8 brake valve. Can the handle be carried in running position if the train pipe is leaky? If so, how? A friend tells me it can be done by moving the handle backward and forward, but I don't "catch on" exactly. A.—First see that the excess-pressure valve is clean and that the spring has no greater tension than 20 pounds. When releasing brakes, move handle to full release position for two or three seconds, and then bring it to running position. In this way the excess pressure is always maintained. If the handle is left in full release too long, the excess will be lost, and when handle is returned to running position, there is no passage from main reservoir to train pipe until the excess is regained. During this time, brakes will creep on if the train pipe leaks. If the excess is once lost, it may be regained by placing handle in running position. When brakes creep on, throw it to full release for an instant, then bring back to running position. Repeat this process until excess has been regained.

(151) J. A. S., Jersey City, N. J., writes:

In reading over your answer to Mr Willets, your statement in regard to the opening of graduating port being less on long trains than short attracted my attention. I would like to ask how many cars we would couple together before we would cease to get the full port opening? Triples to be in good condition, and function of moving parts to be considered as average. A.—1. About 15 or 20 would be a fair estimate. 2. About how much of the graduating port would be open on the 50th car of such a length of train? A.—2. About one-half, or, perhaps, instead of opening that amount and remaining open until the pressure in auxiliary equalized with train pipe, the port might be opened wider, then closed partially, or wholly, for an instant, then opened and closed again. This process might be repeated several times during one reduction, according to how sensitive the triple might be. 3. If train pipe could be kept up to 70 pounds and all triples cut in at once, would not all auxiliaries charge in same time? A.—3. Yes: if a uniform pressure were presented simultaneously and continuously to all triples.

(152) C. B. B., Jersey City, writes:

I have a driver brake that will release at once if a reduction of less than 8 to 10 pounds is made in emergency, on light engine, but is all right if only ten pounds is drawn and valve lapped. Have seen your statement that it may be air in middle chamber going into train pipe. Valve is of the D-5 or E-6 pattern, with groove to allow of escape of middle chamber pressure, so cannot see, in this case, nor those mentioned, how it could occur. Brake whistles off. Pistons travel three inches. A.—The groove which empties chamber D in an emergency operation only performs its function when handle is put in extreme emergency position and left there. If you make an emergency reduction less than 8 or 10 pounds you do not leave handle in full emergency position, and probably never reach there while making the reduction. Consequently the entire chamber D pressure, with the exception of the 8 or 10 pounds goes by the equalizing piston into the train pipe the same as though the groove were not there. This is proved by the fact that the trouble does not occur if you make a heavier reduction.

(153) E. L. C., 11 Royal Terrace, East Kingstown, County Dublin, Ireland, writes:

I have been reading air-brake columns recently with much interest, and would like information on one or two points: 1. I see on page 576, July number, question No. 6, that air comes from auxiliary *only* in service application, and from auxiliary *and train line* in emergency application. I don't understand why this difference is. Kindly explain. A.—1. When a service application is made, the piston and slide valve travels but half stroke, making a single connection between the auxiliary reservoir and brake cylinder. When an emergency application is made, however, the piston and slide valve is caused to make the extreme traverse which makes a double connection to the brake cylinder—one from the train pipe, and the other from the auxiliary reservoir. 2. When releasing brakes, does the triple piston first move to release position when train line air strikes it, or does train line air *first* charge auxiliary, and then shove piston to release? A.—2. The triple first goes to release position. 3. Does the feed groove run the full length of the triple piston casing? A.—3. No, only a short portion of it.

(154) B. W., Port Jervis, N. J., writes:

Why is freight car train pipe 1¼ inches while passenger is 1 inch? I understand it is so the volume of both would be equal for purpose of preventing emergency action on a one-car freight train. A friend, however, says this is wrong. He says the preliminary exhaust can only reduce top of equalizing piston 20 pounds in 5 seconds, so bottom cannot reduce any quicker, no matter if train pipe is only 10 feet long and 1 inch in diameter. I think he is wrong, but the way he puts his argument puzzles me to answer. He cannot explain why the pipe is 1¼ inches diameter. A.—The prime reason for making the freight car train pipe 1¼ inches in diameter is that the rear brakes on a long train may apply quicker in an emergency application. There is less friction to the air in a 1¼-inch pipe than a 1-inch pipe. The 1-inch pipe is amply sufficient for passenger trains, as they are never as long as fifty-car freight trains. The additional pressure a 1¼-inch pipe gives to the cylinder in an emergency application over that of a 1-inch pipe is quite a consideration, but is secondary to that given above. The brake valve has been made to accommodate the pipe, and not the pipe to accommodate the brake valve.

(155) L. O. A., Indianapolis, Ind., writes:

With a F-6 valve, assumed to be in perfect order, engineer reports driver and tank triple whistling off, soon as handle is brought to lap. First one lets go, then the other. It is claimed a weak graduating spring in driver triple was the cause. By putting in a new standard spring, the trouble was overcome. Proper auxiliaries are used. What is your diagnosis? It is claimed there was no auxiliary leak. A.—1. Possibly the light springs allowed the piston in triple to travel its full stroke, where, for some reason or other, it stuck until after the auxiliary had considerably reduced its pressure; then when it started back, its momentum was sufficient to carry it to full release. If this were true, a heavy spring would prevent the piston from getting to where it could stick. Ordinarily, light springs have no effect upon triples to cause them to release. A more plausible reason for the correction of the difficulty is that when the springs were changed, the triple was cleaned, and dirt was taken from under the slide valve. 2. How would this brake act if graduating spring was too weak, or removed entirely from the driver-brake triple? Would it alone release the brake? A.—2. Possibly, but not probably.

(156) R. M., Jersey Heights, N. J., writes:

1. What time should a pump consume in raising air pressure by 10 pounds at a time, coming at 40 to 50 and 50 to 60, and so forth, as noted in question 207, "Progressive Questions and Answers?" Reservoir, 18,000 to 20,000 cubic inches capacity. A.—1. Not more than two minutes, with the 9½, nor more than three with the 8-inch. A more satisfactory answer to this question would be had by taking an engine with a comparatively new pump and make the test. Don't use a pump just overhauled. A trial of several engines with reservoirs of known capacity will soon create a standard. 2. Could you give the average time of charging perfectly empty train of 5, 10, 20, 30, 40 and 50 cars, with full pressure on engine at start, and pump in good condition? This is a question I am frequently asked, and which I can find no information about in any of your books. A.—2. The variable conditions of pump, train pipe and connections, etc., make an answer to this question unsatisfactory. Experiment would give a more reliable answer than any numerical computation. The air brake men will have a committee report on this subject next April, and much interesting and instructive data may be looked for.

(157) A. B C., Seymour, Ind., writes:

Would be pleased to have the following query answered: Have a train of 25 heavy loaded freight cars, 10 head cars equipped with air brakes. Before leaving terminal, brakes are tested and found to work O. K. In making several stops after leaving, all brakes worked properly. Using light throttle on descending grade two cars next to engine broke off, but brake on engine and two cars attached to it does not set until separated about 10 car lengths, and then instantly goes into emergency, thereby causing rear end to overtake first half of train, and resulting in a costly wreck. The eight cars on rear half of train worked properly. A.—A very improbable cause might have been some obstruction in the hose or rear part of train pipe of second car, which refused to allow pressure to escape until the time mentioned. A much more probable cause was that the light throttle was admitting more steam than would at first appear. The engine d tender brakes were slow to take hold, and possibly were not in as good shape as they might have been, but were sufficiently good, with the aid of those on the two cars, to eventually retard the forward secti n so as to cause the collision. And more probable, still, is the theory that steam was not shut off soon enough. We are inclined to scout the first cause, and to lean towards the second quite strongly, and towards the third more strongly still.

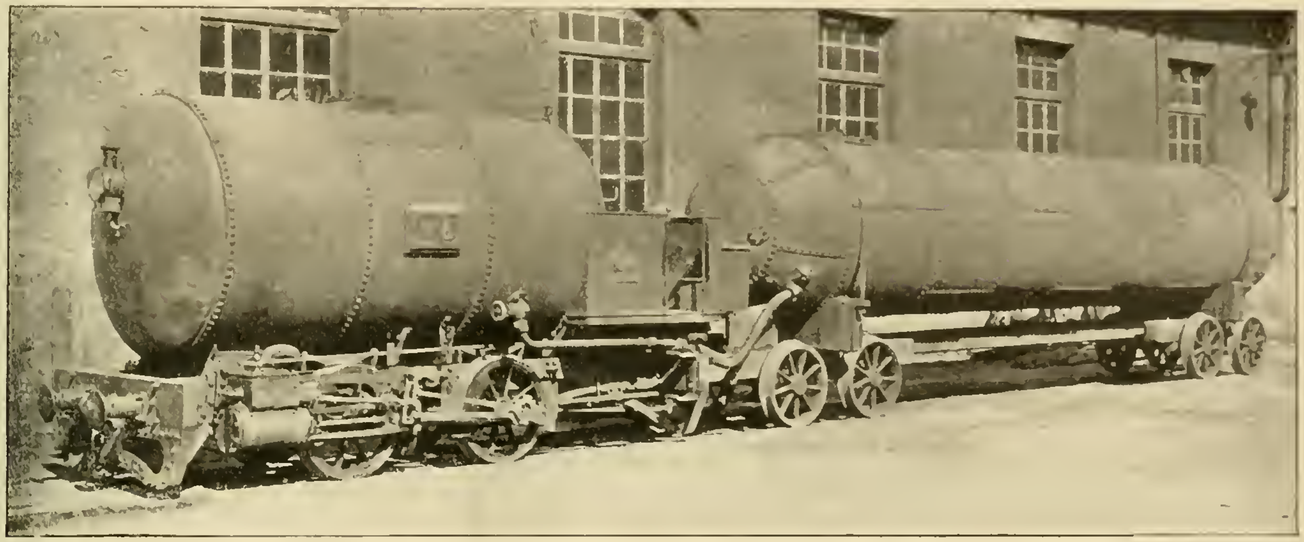
(158) C. B. B., Jersey City, N. J., writes:

It is claimed that if you want 200 pounds of air, but have a boiler pressure only sufficient to supply 100 pounds, you can get your 200 pounds of air by using two air pumps, one pumping 100 pounds into a reservoir, the other drawing air at that pressure from this reservoir can compress it to double that pressure (or nearly so) in another reservoir. I cannot understand how second pump, being operated by steam at a little over 100 pounds pressure, is going to take air at 100 pounds pressure and compress it to 200 pounds. Would you kindly oblige by explaining? A.—The first pump draws in atmospheric pressure and compresses it to 100 pounds in the first reservoir. The suction valves of the second pump are connected to the first reservoir. Instead of sucking in air at atmospheric pressure, as the first pump did, it gets 100 pounds in the cylinder. When the second pump reverses, the first suction valve closes, and the other opens, letting in 100 pounds pressure from the first reservoir to the other side of the piston. This 100 pounds on one side of the air piston and the steam pressure, which is a little over 100 pounds, make altogether more than 200 pounds to force the piston against the 100 pounds, compressing it. In other words, the 100 pounds of air in the first reservoir helps the steam pressure, thereby making an equivalent of more than 200 pounds steam pressure to do the work of compressing the air to 200 pounds.

Curious Compressed Air Locomotive.

As the attention of American railroad men has been attracted a great deal of late years to the operating of locomotives by compressed air, the curious engine hereby shown will be examined with interest. We are indebted to Mr. H. Gretener, of Zurich, Switzerland, for the photograph from which the engraving was made.

This engine was designed for work in the construction of the St. Gotthard tunnel. It was found that the ordinary locomotives gave a great deal of trouble inside of the tunnel, through the smoke and gases emanating from the fireboxes, and the chief engineer of the works determined to try pneumatic traction. In 1874 experiments were made with an ordinary locomotive charged with compressed air instead of steam. The compressed air was carried in a tank on a special car behind the engine. The results of the trial were so satisfactory that Mr. Favre, the chief engineer, ordered two engines from C. R. Eugot, especially built for use of compressed air. One of these is shown in our engraving.



CURIOUS COMPRESSED AIR LOCOMOTIVE.

The pressure at which the machines were run was 210 pounds per square inch. The receiver carrying the necessary supply of air was a tank 7 feet diameter, 11 feet 8 inches long, holding about 275 cubic feet of air. Under the foot-board at one end of the machine was placed a smaller tank of about 14 cubic feet capacity, connected with the large tank with a pipe that reached almost to the bottom, and which could be closed off. Before starting on a trip, the smaller tank was partly filled with hot water and partly with steam at a certain pressure shown by a gage, and then the air was admitted by opening the regulating cocks. After passing through the hot water from bottom to top tank, the air went through a pipe leading to reducing valve.

Driving Boxes with Crown Bearings.

In the published proceedings of the New York Railroad Club for September is shown a sketch of a driving box brass, presented by a member during the discussion of the lubrication subject, to show how a box could be made to run cool, and also to emphasize his contention that hot boxes were due more to mechanical defects than to the lubricant used.

The sketch represented the end view of a brass on an 8-inch journal, and having a bearing in the crown for a distance of 5 inches, measured on the circle. The brass was evidently bored to fit the journal on the 5-inch bearing, and was then reset so as to bore the remaining portion at the sides to a radius of 4 1-16 inches; that is, the brass was open at the lower edge 1-16 inch with a bearing in the crown alone. The engine had 87,000 pounds on four drivers, and great trouble was experienced with the boxes before the change was made in the form of the bearing surface, as described; since the change, there are no hot boxes.

One by one the teachings of our shop days are proved to be fallacies, and we find ourselves leaning on a broken reed all these years. Many a time have we filed wearily at the crown of a brass in order to get the open sides to come up to the journal. Many a shim have we put between the brass and box, with the object in view of closing in the sides and getting out that pound, when the brass had less, much less, wear at the sides than 1-16 inch, and our memory still serves to recall the first and only box we ever bored too large, and also our difficulty in convincing the too critical foreman that our calipers must have moved on us.

Those were the days when a fit was properly made only by a contact of the brass over the whole bearing surface; the sides scraped to a touch slightly tighter than at the crown, so that when the weight of the engine came on the wheels, the spring of the box would force the sides of the brass apart enough to equalize the fit over the whole surface.

A prominent trunk line has, we understand, been using a crown bearing in their driving boxes for some time, but with what success we have not heard. We cannot but believe, however, that the freedom from heating in the cases noted is paid for by a reduced life of the wearing and adjacent parts, and a consequent greater cost for maintenance, for the reason that the scheme is based on an initial lost motion, a condition that will obtain without encouragement. If the crown bearing is what we require for cool running, a revision of our theories of projected areas, and safe loads thereon, will be in order.

Quite a number of miles of new 80-pound steel rail has been laid on the Columbus & Newark division of the B. & O., replacing 67-pound rail. Almost half a mile of trestle has been converted into an embankment on the same division. Other improvements on the B. & O. lines west of the Ohio river include a four-span steel bridge, 600 feet long, across the Muskingum river, at Zanesville, and two iron bridges on the Midland division.

The eccentric as a means of transmitting movement to the valve motion of a steam engine, was invented by William Murdock, a Scotch engineer, and patented in 1799. Before that time the valves were operated first by hand gear, and then by rather crude attachments to the piston connections.

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Why We Are Becoming the Locomotive Builders of the World.

Within one week last month the Baldwin Locomotive Works received orders for fifty-eight locomotives for foreign countries, and it has set the press into ecstacies over the progress of American industries, and predictions are freely expressed that the United States is destined in the near future to become the machine shop of the world. Various wild theories are expressed concerning the causes which have given American locomotive and machine builders the lead of their competitors in foreign countries where labor is materially cheaper than it is on this side of the Atlantic. The working of protective tariffs is credited with no small share of the good fortune coming to our mechanic industries. We have nothing to say against the economic policy of our government, but we have for years watched the methods pursued by our manufacturers to reduce the cost of production, and we firmly believe that therein, and not in political interference, lies the source of America's future potency as a manufacturing nation.

To follow the causes which have paved the way that led American methods of machine production onward to the front of the procession of nations, we must go back more than a century when Eli Whitney, inventor of the cotton gin, introduced into armory work a system of interchangeable reproduction of parts. Before his time every part of a gun was made for that particular gun, and would not fit any other. Whitney devised the plan of making every stock, lock and barrel exactly alike. The parts were finished in formers, jigs and templates, and then all that was to be done to produce a finished gun was to assemble the parts together.

The system was new and strange, and therefore worthy of being regarded with suspicion, and Whitney was looked upon by many as a harmless crank, and his system made little progress for a few years. But self-interest is more powerful than conservative notions. Skilled labor was always dear in this country, and after a time the men in New England, who were striving to keep alive the infant mechanical industries, turned to the Whitney system as a means of lowering the cost of production to meet outside competition. The clock makers of Connecticut were the first to adopt it extensively, and they worked it so successfully that a few years afterwards they were sending their clocks into every market of the world, and underselling the cheap labor of Europe. Sewing machine makers and all other makers of small articles of common size followed the example of the clock makers and profited accordingly.

The interchangeable system of production is better adapted to small articles than to large pieces, and it made slow progress into the shops where steam engines and heavy machinery were constructed, but it made progress. Twenty years ago makers of small steam engines were turning out engines that had the parts as exactly interchangeable as the parts of a sewing machine, and, gradually the system was making its influence felt in locomotive building works. Great difficulties were encountered in adapting the Whitney system to locomotive building, principally because there is so much diversity in the parts of the locomotives ordered by railroad companies. But some of the highest engineering talent in the country was for years wrestling with the problem, and a system of production was worked out which reduced cost to surprisingly low terms. From the incipiency of the interchangeable system of production, it was found most satisfactory to do the work by the piece in preference to day labor. American workmen are so much accustomed to piece work that very little sentiment exists against it. Piece work has encouraged mechanics to devise improved tools and perfected methods in doing their work, and the extraordinary low cost of labor on some machines has resulted from the use of ingenious tools produced by workmen and patented by the inventor. Another influence it has is to make the men in charge of a shop keen to see the merits of any new tool. When a machine tool has been put upon the market which promises to reduce the cost of production the men in charge of every first class locomotive shop in the country proceed to calculate whether or not it would pay to throw out a good tool to make place for the latest article. They generally decide to purchase the new tool. The expression is often heard among our locomotive builders: "We cannot afford to use worn out tools." From what we have seen of the shops of our competitors abroad we think the prevailing policy is: "We cannot afford to buy new tools."

These are the influences which are giving the United States locomotive builders the markets of the world. The given principle of supply and demand calls for cheapness, and our locomotive builders are in a position to undersell all competitors, just as the Connecticut clock-makers did three-quarters of a century ago.

Nine years ago the writer made a tour among the principal locomotive building shops in Europe, in company with the manager of one of our largest locomotive works, and we naturally were comparing shop methods as followed there and with us. We both expected to learn something from foreign practice, but were disappointed. We were aware that when a foreign order for locomotives was awarded to an American firm, when British builders were bidders, that the British engineering press howled that the use of inferior material enabled Americans to underbid their British rivals. We were anxious to find out the truth of the matter, and took notes.

On returning home, the writer was constrained to publish in his journal an article to this effect:

"In spite of the low wages paid to skilled mechanics in Glasgow, the cost of building a locomotive there is considerably higher than it is in the United States. When Bret Harte was American Consul in Glasgow, one of his reports to our government brought this fact out very decidedly, but the accuracy of his conclusions was questioned by those concerned in promoting British interests. We recently secured information which corroborates the correctness of Consul Harte's conclusions. One of the leading Glasgow locomotive builders built 200 locomotives last year, while employing, on an average, 2,500 workmen; a well-known American firm in the same time built 300 locomotives, while employing 1,400 workmen. Allowing 300 days for a year's work, the American firm put the labor of one man for 1,400 days on each engine finished; the Scotch builder, on the other hand, puts the labor of one man for 3,750 days on each locomotive turned out of the shop. The weight and power of the American locomotives greatly exceeded those built in Glasgow."

That was a statement of facts which ought to have received attention from those interested in conserving British trade. Did they accept it in the spirit that begets progress? Not at all. The leading engineering journals denounced the statement, and said that it was a parcel of Yankee lies. Since that time American locomotive builders have been steadily reducing the man-days necessary to finish a locomotive, and British builders have remained almost stationary. The large foreign orders that have come to American locomotive builders are the beginning of the end that will see British locomotive builders out of the foreign market.

Among recent orders placed in the United States are eighteen locomotives for the Grand Trunk of Canada. There is at Kingston, Ontario, locomotive works that could build all the locomotives used in Canada, if they were properly equipped and operated, and they are protected by a tariff duty of from 30 to 35 per cent. ad valorem on all locomotives imported; but the United States builders underbid them on almost every order, although wages are lower and living is cheaper in Canada than they are in our industrial centers. Why is this thus? It is because the Kingston Locomotive Works are controlled by a firm in Scotland which "cannot afford to buy first-class tools," or endure the expense of reorganizing the shops to work on American methods.

Railroad Employes Buying Railroad Stocks.

Several railroad companies are encouraging their employés to purchase shares of the capital stock of the companies with their savings, and other railroad companies are contemplating similar action. The employés who are willing to make investments of this kind are helped in the details of converting their money into certificates of railroad shares. They are encouraged in every way to make that kind of investment, and saving them the trouble of conducting negotiations they are unfamiliar with, no doubt helps to overcome their natural reluctance to putting their savings into stocks of any kind. It would no doubt be a good thing for railroad companies generally if the greater part of their employés converted all their savings into stock of the company they work for, but we are sceptical of the good likely to accrue to the investor, because we very much doubt the stability of the investment. The control and management of railroads is too much a speculative football, kicked hither and thither by the bulls and bears of stock exchanges, to be a secure investment for the hard-won earnings of workmen. If small holders of railway stocks had any direct share in the management or policy of the company, they might be in a position to sell in time when a policy was adopted calculated to depreciate the value of their property; but they can never expect to make their stock voting power felt. They know nothing about the machinations going on in Wall street, and the company they have put their little all in may suddenly pass into the hands of a receiver before any of the employés has heard expression of the least suspicion that the affairs of the company were not in a flourishing condition.

To those who own shares of railroad stock, and to others who may contemplate investments of that kind, we will relate a small passage of personal history, which may serve as an object-lesson. Some four years ago, the writer had $5,000, which he had drawn from various sources for the purpose of paying a mortgage. When the money was offered, the borrower discovered that the bond had another year to run, and the lender refused to take the money. While we were looking out for some investment to hold the money for a year, an acquaintance suggested that we put the money into railroad stocks, which were then very low. This party was a Wall street man, and earnestly expressed the opinion that stocks must have a substantial rise within the year.

The writer is fairly well acquainted with the physical condition of most railroads, and in this instance he carefully investigated the financial burdens of two or three roads whose stock might be a good investment. He put the $5,000 in preferred stock of a railroad which seemed financially sound. For a few months the stock fluctuated at about the price paid for it, and then it began to fall. It fell steadily, without any apparent cause. The writer supposed it was a temporary bear movement, and that the value of the stock would rise again, and so he held on. The bear movement was permanent, and ended in wiping out the entire value of the stock. The property went into the hands of a receiver, and when reorganization came about, an assessment was put upon the stock which was nearly equal to the price paid for it. Rather than pay that, we let them wipe out the value of the stock, and it proved a wise course. The president, who became receiver, and his friends, who forced the company into bankruptcy, were a gang of thieves. But when any protest was uttered, they were in the position coolly to ask, "What are you going to do about it?"

The financial disasters that have overtaken many railroad companies whose capital stock seemed as good as United States bonds, ought to be a warning to small investors to keep away from railroad stocks. To those who have stocks of this kind, we would say: If you want to hold railroad securities, convert them into bonds. Bonds are fairly safe, and their value is likely to advance for a year or two, unless some disaster overtakes the country. But beware of all stocks that are manipulated by Wall street.

A Little Learning Is a Useless Thing.

There seems to be no appreciable diminution in the number of those who believe that in the pursuit of the knowledge wherewithal to handle the everyday problems of their business, there may be some path across lots by which the coveted goal can be reached by them, leaving to the plodder or the one supposedly less favored with healthy brain tissue, to laboriously traverse the four sides of the quadrangle, and then be not as well fitted to cope with matters mechanical as the one quick to reach conclusions.

Royal roads to learning have always been, and always will be, a chimera, ending in disappointment in its indulgence. This has been best understood by those that have nothing but failure to show for misdirected effort; but this outcome, while convincing to the individual lapping up experience, is of small moment to the legions following, and who are tiring themselves out in pursuit of the same evanescent dream.

It is wisely provided by natural laws, that we cannot have something for nothing, that results are the outcome of effort, and that without application and drill, no lasting benefits need be expected by the student. This proposition is best proved by the facility with which the skimmer of facts forgets his too easily acquired knowledge; all due to the neglect to learn principles instead of things. And here is the point around which turns success or failure; the principle involved is the very essence of a question or problem, and once mastered, the solution is easy, not only for the one case, but for every similar case. Rules and formulas will then no longer be required to be memorized, simply because they will have been learned when the foundation on which they are reared is understood—that is, the principles from which they were built up—and the formula comes as a natural sequence to the reasoning out of a perplexing question.

The habit once formed, to get at facts on these lines, is the best possible preparation for a study of text books, for the reason that one is brought to a closer understanding of the derivation of the formulas used therein, because better able to comprehend the reasoning from which they were deduced, thus at once being freed from a blind acceptance of a proposition on pure faith alone. This, it will be seen, is an impossibility without work—hard, painstaking work—as all know who have trudged along on an almost fruitless still hunt for a broader knowledge, in their efforts at self-education, spurred on by the hope of reward at last.

Thoroughness is only attained by long-continued application, not by short-cuts nor superficial thought. The world's best minds never think about royal roads to reach conclusions when engaged in the solution of cases of weighty import, whether questions of state or those involving technical learning. The example is one well worthy of emulation by all who are laying the foundation for future success by self-education, bearing in mind the fact that details are of more importance than generalities, and therefore demand the closest attention, whatever the study may be, for on a knowledge of them hinges a correct understanding of the whole. Only by such a course will study prove of lasting benefit, or shield the student from the accusation of pretending to virtues he cannot possess by following in the path of those who do not understand the need of painstaking application, and who, when too late, see as a result of wasted time (to paraphrase Pope's words), that a little learning is a useless thing.

Engineers' Views About Compound Locomotives.

In the course of a recent protracted journey, we determined to investigate compound locomotives from the standpoint of the locomotive engineer. To obtain the information wanted, we entered into a conversation with all the enginemen we met, and invariably asked them what they thought of the compound? One of the first answers received was both startling and suggestive. The engineer said: "Well, I get along first rate with the compounds, and I have no difficulty in keeping the Smith exhaust pipe working all right, but some of the other men talk against me for doing my best to make everything put into my charge work properly." After that, a great many engineers were interviewed with varied results. A few were quite favorable to the compound, and expressed the opinion that it was the coming engine for freight service, but most of them were exceedingly shy in giving their views, and a few said plainly it was no good, and never would be a successful locomotive. When cornered to tell on what their want of faith was founded, they were dumb, or said that compound locomotives were too complicated, or that they rode hard. Most of them admitted that the engines were light on fuel. All the firemen we interviewed expressed themselves to the same effect as to fuel.

The locomotive engineer is the most conservative man in the community so far as changes and improvements on locomotives are concerned, and it is natural that he should be so. He likes to listen to familiar sounds, and to handle parts that habit has helped him to reach under the most trying circumstances of locomotive running, and the difficulties are numerous enough. On this account, we have warm sympathy for the man who objects to new appliances, but our sympathy does not disguise the truth that the man's judgment is at fault when he objects to improvements that are in the line of progress. His objections to compound locomotives, Smith exhaust pipes, and other advanced appliances, are in line with the feelings that led engineers of an earlier generation to object to injectors, air pumps and sight lubricators. When the men became familiar with these devices, they wondered why they ever objected to them, and it will be the same with compound locomotives and every other improvement yet to come.

Men who object to improvements designed to reduce the expense of operating locomotives are not so far-seeing as they ought to be. There are indications that the steam locomotive may in the near future have rivals that will try to chase it off the track. The more economically the locomotive can be made to do the work of train hauling the longer it will defy competitors. For that reason locomotive engineers ought to welcome every improvement, and do all in their power to make them work successfully. We believe that this view of the case has struck very few engineers. If they reflect seriously about it, we believe that fewer captious criticisms will be heard of the compound locomotive.

American Tools Abroad.

It has long been notorious that anything savoring of the least trace of American origin was treated by "The Engineer," of London, as though there could be no possible excuse for its stay on earth. Such has been its attitude especially with reference to American tools, motive power and machinery, and its arraignment of their faults, with all the bile that a blindly prejudiced spleen can afford, is more a matter of amusement than one for serious consideration by those who understand the animus that moves their gall-tipped pen.

In its last spasm over the importation of American tools into England, it attempts to get a prop under itself by the statement that "the American tool is not adapted to English work," and proceeds to paralyze the tool by an attack on the crank handles—calling them too short—also the use of small hand-wheels in their stead. After an acknowledgement that the handles will give the same power as those on English machines, the kick is summed up in their belief that they "do not give the same *sense* of power and security."

Referring to the capacity of output of the respective builds of tools, another opportunity was seized to show the inferiority of the American machine, by dwelling on the fact that American cast iron is a softer material than the English product, and that American machines would show to better advantage in the way of speeds and feeds, in consequence. These are characteristic samples of the means taken to belittle tools that are forcing their way to the uttermost parts of the world, in spite of these appeals to conservatism and sectional prejudice. We will say that the American tool has shown itself adapted to work whereever found, and that soft cast iron does not measure its capacity for work by any means. It has shown its ability to hold its own in every instance, even under most adverse conditions. If the American tool has faults, they will develop quick enough in the usual way—the crucial test of shop service—and will not require the assistance of printers' ink to make them patent to the user. The time has gone by for any feeble attempts like the above to stem the tide of American tools toward foreign marts. They have too good a start at this time, as a reward of merit. The question of where they were built does not enter into the problem; the fact that they can be made to turn out good work is the gage of their acceptance, and is alone responsible for their success as paying factors in shop management. We are content to abide by the decision of the unbiased intelligence of the Englishmen who handle our tools in the shop; theirs is the judgment we are interested in.

Against Extending Time for Application of Safety Appliances.

A variety of railroad labor organizations have combined to apply to the Inter-State Commerce Commissioners against any extension being given of the time in which to comply with the law requiring railroads to equip all their freight rolling stock with air brakes and other safety appliances. We do not believe that the protests of the labor organizations will receive so much consideration as they ought to have, but those interested may make up their minds that the safety appliances will be put on without very much delay. The delinquent railroad companies may appeal successfully to the Inter-State Commerce Commission to have the time extended; but those who have their cars equipped with safety appliances will exercise a greater influence on delinquent railroads than what laws or even public opinion can do.

It is pretty well understood that the leading railways which have complied with the law will refuse to accept cars in interchange, which do not have automatic couplers and air brakes. When a railroad company finds that these cars reaching interchange points are emptied, and the freight transferred into cars having safety appliances, self-interest will soon convince them that safety is the better part of valor.

A little work of ninety pages, in which the elementary study of machine proportions is treated in the clear style characteristic of the author, is that of "The Elementary Principles of Machine Design," by Mr. J. G. A. Meyer, whose work in the field of locomotive engineering is too well known to our readers to need an introduction. The book is one of those that is actually needed to fill a void existing in literature of this kind, in that it places in the hands of the student a work coming within his means, and begins at the bottom with the simplest examples of design, giving reasons for the adoption of certain dimensions and forms to resist known working stresses. The chapter on the slide valve is one of the best we have ever seen for a beginner, and while the book is replete with principles, it also furnishes valuable data and points to the reader for acquiring a good grounding in mechanical drawing, as the examples are laid down in accord with best drawing office practice. The book is published by The Industrial Publication Company, New York. It is also on sale by our book department; price 25 cents.

We notice that a committee of the Master Mechanics' Association, of which Mr. T. W. Gentry is chairman, is going to report, at next convention, on "Advantage of Improved Tools for Railroad Shops." The subject is one on which a very interesting and edifying report can be made, and we trust it will have influence in relegating numerous ancient tools to the scrap-heap or to the Field Museum of Railroad Antiquities. If it aids in bringing railroad managers to a sense of the expensive policy of using worn-out machine tools, a useful work will be accomplished. This is a good time for airing the iniquities of worn-out tools, for our railroad shops are full of them. Almost the first effect of hard times is to stop the purchase of tools, no matter how urgently they may be needed. It is short-sighted policy, but so is that of permitting rolling stock and track to run down. Railway earnings are steadily increasing, and efforts are making on most roads to put the machinery back into decent order. This work would be greatly facilitated and cheapened, if the shops were provided with the necessary tools.

Philadelphia seems to stand at the head of other cities for getting out freak devices for railroads and otherwise. The latest invention of Philadelphia is a revolving railroad, by which people are expected to get through the world at the rate of 150 miles an hour.

PERSONAL.

Mr. J. M. Percy, master mechanic of the Cincinnati, Hamilton & Dayton, at Cincinnati, O., has resigned.

Mr. P. Bruner, superintendent of the Cleveland, Lorain & Wheeling, at Uhrichsville, O., has resigned.

Mr. A. S. Bosworth has been appointed purchasing agent of the Maine Central, with headquarters at Portland, Me.

F. J. Ferry, master mechanic of the Louisville, Henderson & St. Louis, died at Cloverport, Ky., last month, aged 52 years.

Mr. Samuel Thomas has been chosen vice-president of the Charleston & Western Carolina, to succeed Mr. W. A. C. Ewen, resigned.

Mr. George W. Ristine, receiver and general manager of the Colorado Midland, has been chosen president of the reorganized company.

Mr. W. Rice has been appointed master mechanic of the Michoacan & Pacific, taking the place of Mr. H. A. O'Brien. Office at Zitacuaro, Mex.

Mr. A. A. Patterson, Jr., president of the Milwaukee, Benton Harbor & Columbus, has also been elected president of the South Haven & Eastern.

Mr. W. J. Miller has been appointed master mechanic of the Southern division of the Kansas City, Pittsburg & Gulf; headquarters at Shreveport, La.

Mr. Henry W. Gays, general manager of the Chicago, Peoria & St. Louis, has also been appointed general manager of the St. Louis, Chicago & St. Paul.

Mr. Joseph McCabe has tendered his resignation as division superintendent of the Northern Pacific, at Tacoma, Wash., to engage in an Alaskan enterprise.

Mr. Joseph Billingham, master mechanic of the Baltimore & Ohio, at Garrett, Ind., has been transferred to the Pittsburg division at Glenwood, Pa.

Mr. Alberto Villasenor, master mechanic of the Ferro-Carril Santa Ana, has been appointed master mechanic of the Ferro-Carril Central, Salvador, C. A.

Mr. John Fridinger, after twenty years as engineman for the Western Maryland Railroad Company, has been appointed roundhouse foreman at Hagerstown, Md.

Mr. W. B. Storey, Jr., chief engineer of the San Francisco & San Joaquin Valley, has been appointed general superintendent; headquarters, San Francisco, Cal.

Mr. E. W. Grieves, superintendent of the car department of the Baltimore & Ohio, at Baltimore, has resigned to engage in other business, and that office has been abolished.

Mr. A. D. McCallum has been appointed master mechanic of the Cincinnati, Hamilton & Indianapolis division of the Cincinnati, Hamilton & Dayton Railway, at Hamilton, O.

Mr. J. G. Livingston, purchasing agent of the Lexington & Eastern, has resigned to accept the position of general superintendent of the Interoceanic Railroad of Honduras, C. A.

Mr. C. F. McDermott, general foreman of the Baltimore & Ohio shops at South Chicago, Ill., has been appointed master mechanic at Garrett, Ind., vice Mr. Joseph Billingham, transferred.

Thomas S. Ridgeway, for many years president of the Springfield & Illinois Southeastern, now a part of the Baltimore & Ohio, died last month at Shawneetown, Ill., aged 71 years.

Mr. A. J. Ball, division master mechanic of the Cincinnati, Hamilton & Dayton Railway, at Dayton, O., has been promoted to be assistant superintendent of motive power of that road, with headquarters at Cincinnati, O.

Mr. J. T. McBride, general manager of the Duluth, Missabe & Northern, has resigned, and that office has been abolished. All matters pertaining to that department should be referred to W. J. Olcott, vice-president, Duluth, Minn.

Mr. A. O'Hara, division superintendent of the St. Louis & San Francisco at Neodesha, Kan., has been appointed superintendent of the St. Louis division, with headquarters at Springfield, Mo., succeeding Mr. J. A. Mantor, resigned.

Mr. W. A. Robinson, chief clerk to Division Superintendent C. M. Rathburn, of the Missouri Pacific, at Atchison, Kan., has accepted the position of chief clerk to General Manager Doddridge, of the same road, at St. Louis, Mo.

At the annual meeting of the Georgia Railroad, last month, Mr. C. H. Phinzy resigned as president, and his cousin, Mr. Jacob Phinzy was chosen to succeed him. Mr. Leonard Phinzy, a brother of the new president, was chosen vice-president.

Mr. J. B. Braden, assistant superintendent of motive power and cars of the Wheeling & Lake Erie, has been promoted to the position of superintendent of motive power and cars, succeeding O. P. Dunbar, deceased. Headquarters at Norwalk, O.

Mr. A. J. Frazer, division superintendent of the Southern, at Birmingham, Ala., has been appointed superintendent of the Wheeling & Pittsburg divisions of the Baltimore & Ohio, with headquarters at Pittsburg, Pa., vice Mr. M. B. Cutter, resigned.

Mr. C. B. McCall has resigned as general manager of the Litchfield, Carrollton & Western Railroad, and that office has been abolished. Mr. T. W. Gerr has been appointed superintendent, and will assume all duties heretofore devolving on the general manager.

Mr. L. B. Paxson, superintendent of motive power of the Philadelphia & Reading, at Reading, celebrated the fiftieth anniversary of his connection with that road recently, and in honor of the event a number of the officials and his associates tendered him a banquet.

Mr. Will White, Jr., assistant general foreman of the Pennsylvania Company's shop at Wellsville, O., has been appointed general foreman of the Illinois Central shops at Freeport, Ill. Mr. White has been a very efficient foreman, thoroughly liked by his subordinates, and respected by his superiors.

Mr. M. B. Cutter has been appointed superintendent of transportation of the Lehigh Valley Railroad, with headquarters at South Bethlehem, Pa. He will have authority to issue instructions relating to transportation, movement of trains, distribution of cars and assignment of motive power.

Any supply firm wanting a first-class, energetic man to represent their goods with railroad officials, can hear of a first-class man by writing to the editor of "Locomotive Engineering." The man we are prepared to recommend has an exceptionally good acquaintance among railroad officials, has an excellent address, is energetic and a gentleman.

Mr. E. O. McCormack, general passenger traffic manager of the Big Four Route, Cincinnati, is giving a fifty cent piece of music for ten cents, to test the value of the different papers as advertising mediums. The piece is the latest and prettiest two-step of the day. Send ten cents in stamps, and mention that you saw the offer in Locomotive Engineering.

Mr. J. J. Clair, whose writings are well known to our readers, has been appointed supervisor of engines and trains of the Pittsburg division of the Baltimore & Ohio Railroad. Mr. Clair, who is a remarkably clear writer on locomotive engineering subjects has been twenty years in railroad service as fireman and engineman, the last thirteen years of that having been in passenger service on the Baltimore & Ohio.

Mr. G. F. Black, formerly superintendent of the Quebec division of the Maine Central, and more recently assistant engineer of the whole line, has been appointed division superintendent of the division formed by the consolidation of the Mountain and Quebec branches. Mr. Morris McDonald, assistant to General Manager Evans, has had his official title changed to general superintendent. This involves no change in his duties.

We received a letter last month from Mr. W. F. Galbraith, master mechanic on the Mexican National Railway, directing his paper to be sent to Santiago, Mexico, as he has been moved from San Luis Potosi to that place. In the course of the letter Mr. Galbraith writes: "These are the main shops on the system, having some sixty engines on the division. We have our own foundry and car works, and build half the cars that the company are using. In addition to that, we do a large amount of outside job work for private parties."

A wicked joke was played on our genial friend, Mr. C. A. Moore, of the firm of Manning, Maxwell & Moore, during the hot time of the election for the officers of Greater New York. Mr. Moore is president of the Montauk Club, of Brooklyn, is a personal friend of General Tracy, and was one of the warmest supporters of that candidate for mayor. As a testimony of how he stood, Mr. Moore had a portrait of General Tracy displayed in one of the upper windows of his house. One night some wags got a ladder, and went up and pasted a portrait of Seth Low, the opposing candidate, over that of General Tracy. It was only when his friends began to inquire of Mr. Moore what had happened to send him over to the other camp that he learned what had been done. Mr. Moore is an emphatic sort of a gentleman, and we shall not attempt a description of how he expressed his displeasure.

EQUIPMENT NOTES.

The Ann Arbor Railroad are having 400 freight cars built at Pullman's.

The Seaboard Air Line are in the market for 450 box cars and 200 flat cars.

Haskell & Barker are engaged on an order of 1,500 freight cars for the Illinois Central.

The St. Charles Car Co. are building fifteen freight cars for the Arkansas & Choctaw.

The Union Pacific, Denver & Gulf are in the market for five locomotives and 300 freight cars.

The Georgia Car Co. are having twenty-five freight cars built by the Ohio Falls Car Co.

The Atchison, Topeka & Santa Fe are having 250 freight cars built by the Wells & French Co.

The Barney & Smith Co. are building 100 freight cars for the Cincinnati, Hamilton & Dayton.

The Missouri Car & Foundry Co. have 100 freight cars under construction for the Missouri Pacific.

The Omaha, Kansas City & Eastern are having 100 freight cars built at the St. Charles Car Works.

The Kan Sei Railway of Japan are having six engines built at the Pittsburgh Locomotive Works.

The G. H. Hammond Co. are having fifty freight cars built by the Michigan Peninsular Car Co.

The St. Louis & Southwestern Railway are having 100 freight cars built at St. Charles Car Works.

The Ensign Car Mfg. Co. are building 100 freight cars for the San Francisco & San Joaquin Valley Railway.

The Colorado & Northwestern are having twenty freight cars built by the Barney & Smith Company.

The Barney & Smith Co. are building fifty freight cars for the Colorado & Northwestern Railway.

The Iowa Central Railroad have ordered 100 cars from the Terre Haute Car Manufacturing Company.

The Lima Locomotive & Machine Co. are building 100 freight cars for the Atlantic & Danville Railway.

Three ten-wheel engines are being built at the Schenectady Locomotive Works for the Fitchburg Railroad.

The Great Northern Railway have ordered two mastodon engines from the Brooks Locomotive Works.

The Menasha Wooden Ware Co. are having fifteen freight cars built at the Haskell & Barker Car Works.

The Consolidated Rolling Stock Co are having 100 freight cars built at the Michigan Peninsular Car Works.

The Chicago & West Michigan Railway are having 100 freight cars built by the Michigan Peninsular Car Co.

The Ohio Falls Car Co. are building 200 freight cars for the Cincinnati, New Orleans & Texas Pacific Railway.

The Pittsburgh & Western Railway have ordered twenty-five gondola cars from the Youngstown Car Works.

The Norfolk, Virginia Beach & Southern are having eighteen freight cars built at the South Baltimore Car Works.

The Youngstown Car Works have received a contract for ten new hopper-bottom cars for Mortimer, Myers & Co.

The Ensign Manufacturing Company have received an order for 500 box cars from the Norfolk & Western Railway.

The Lackawanna Live Stock Transportation Co. are having thirty-two stock cars built at Jackson & Sharpe Car Co.

The Pittsburgh Locomotive Works are engaged on an order for two six-wheel connected engines for the Union Railway.

The Pittsburgh Locomotive Works have an order for one six-wheel connected engine for the Arkansas & Choctaw Railway.

The Brooks Locomotive Works are building one eight-wheel engine for the Buffalo, Rochester & Pittsburgh Railway.

The Rio Grande Western Railway have

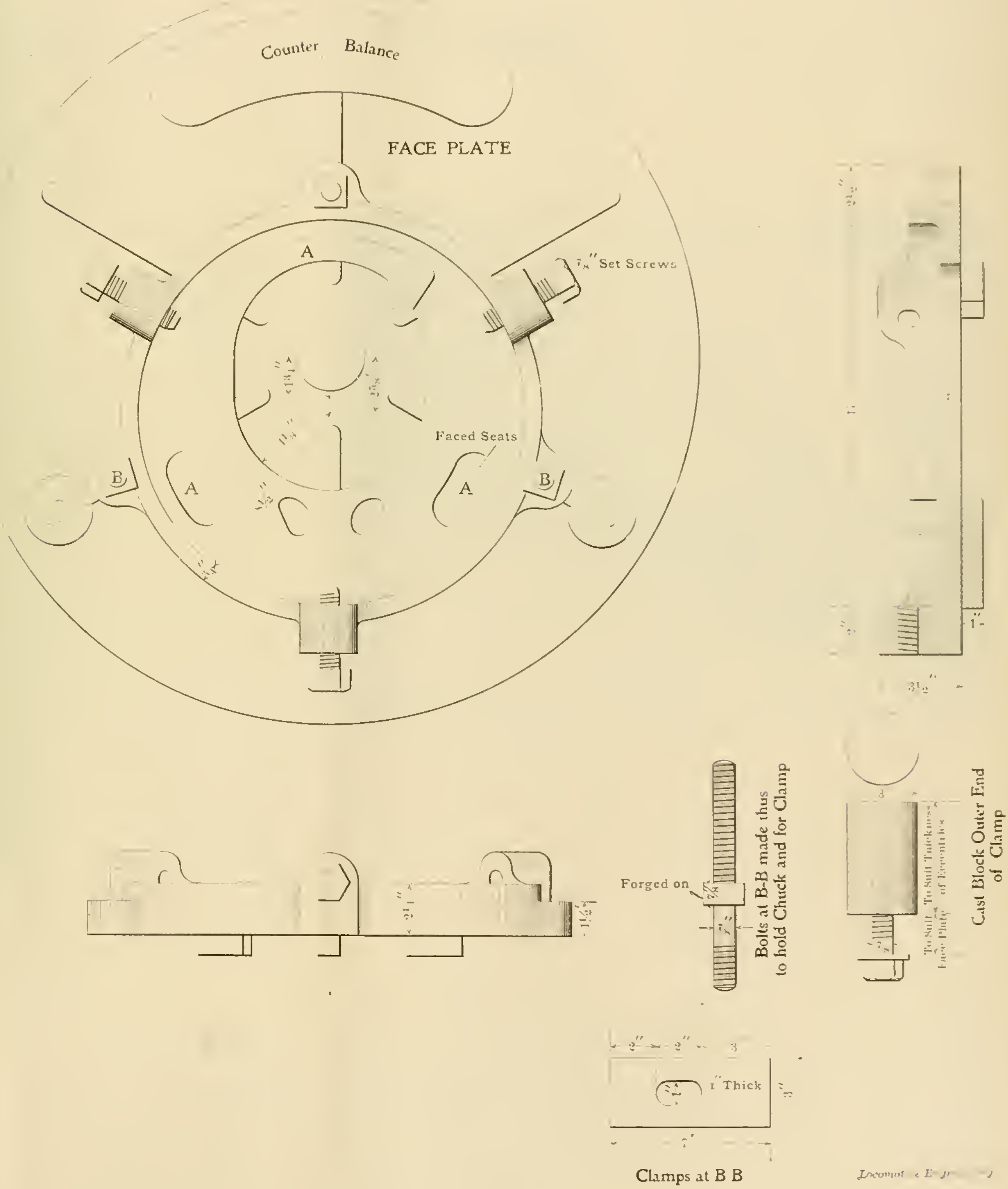
(Continued on page 927.)

Chuck and Boring Bar for Eccentrics.

The practice in fitting up eccentrics on the Louisville & Nashville Railroad is somewhat different from that on many railroads in the matter of boring and turning. By the system illustrated, on the lines devised by Superintendent of Motive Power Leeds, absolute uniformity in fits is obtained besides that desirable status of things in shop economy—interchangeability.

Eccentrics are held in a chuck secured to the face plate as shown, for boring; the chuck being a light but stiff casting with three lugs for the holding and adjusting screws on the front, and three lugs on the back to fit the slots in face plate. With such a chuck, an eccentric is quickly and accurately set ready for the boring tool. The roughing out is done with an ordinary boring tool, but the fine work, the operation that produces the accuracy aimed at, is reserved for the special boring bar shown in detail. This bar consists of a sliding cast-iron head 7¾ inches in diameter, containing six cutters dovetailed in. The head is held from turning on the bar by means of a feather let in flush with the ends, which prevents any rotary motion of the head, but does not interfere with a longitudinal movement on the bar, between which and the head there is a sliding fit over the thread which is cut on three-quarters of the length of the bar for the hexagon feed nut.

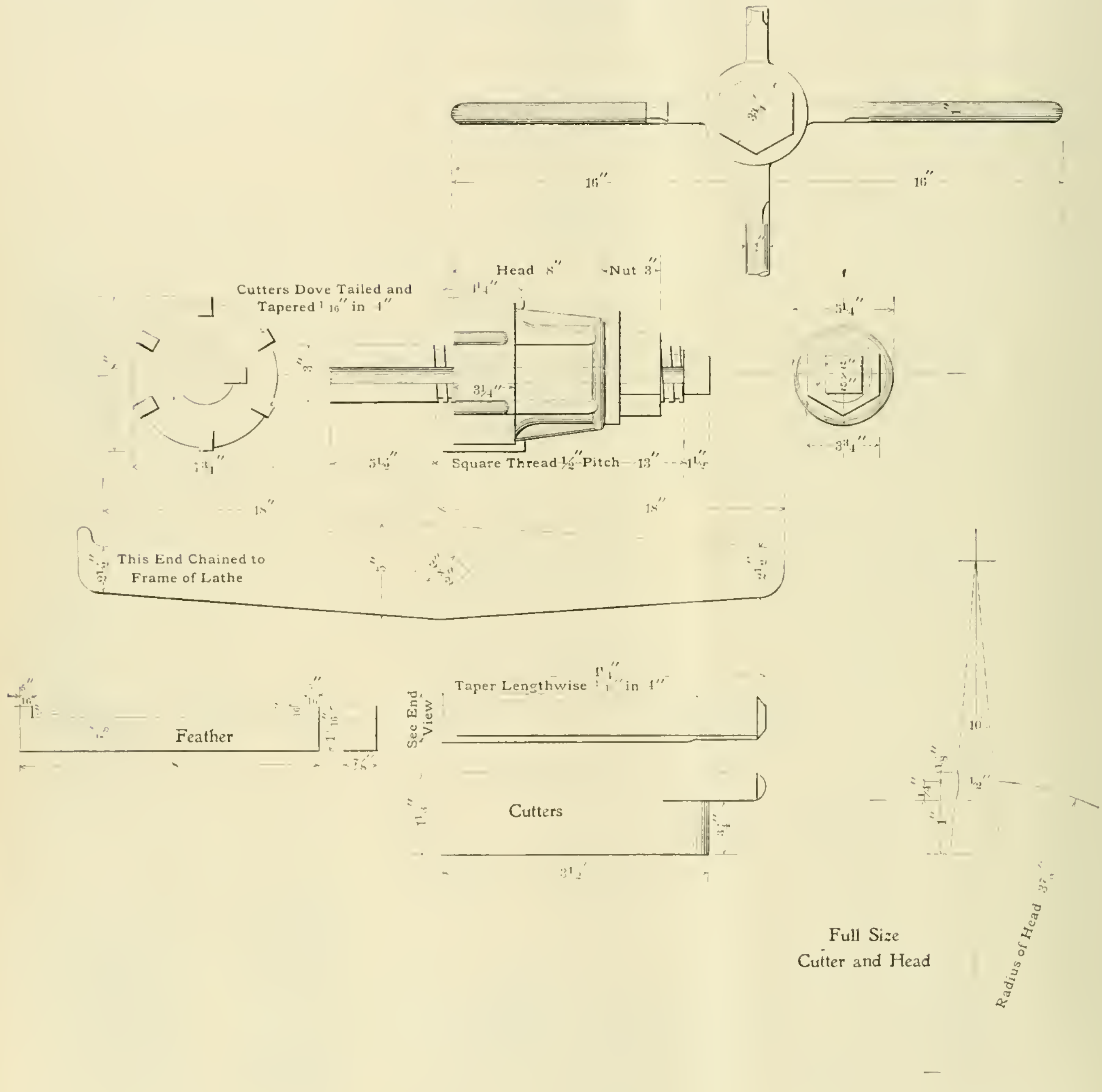
In operation the bar is carried on the



CHUCK FOR ECCENTRICS.

lathe centers and held rigidly by a long lever which fits the square end of the boring bar. The cutter head is then fed through the bore of the eccentric by hand, by means of the star wrench which fits the hexagon nut on the boring bar. There is no labor on the cutters involved in the use of the boring bar, since their only duty it to scrape the hole to fit a standard plug gage for the size of axle the eccentric is to fit. Since all axles are turned to ring gages belonging to the system of which the plugs used are a part, it follows that the uniformity in fits spoken of must be an assured fact.

The care and pains taken in the turning of the eccentric for the strap fit is fully repaid in results after the job is finished, not so much from its truly cylindrical surface, as from the fact that the eccentric is under the strain of the set-screws while on the mandrel to be turned, and therefore under actual service conditions, and further, that the eccentric is held against the cut on the mandrel by means of a key whose center line coincides with the center of the eccentric. This is the feature that makes the job an interchangeable one, for the reason that the eccentric may be reversed on the mandrel without impairing its truth, and it may therefore replace any other eccentric of the same bore with full confidence that the angular advance will be correct, without the use of offset keys in the axle. These are some of the advantages of having special tools and using them.



Locomotive Engineering

BORING BAR FOR ECCENTRICS.

A newspaper paragraph from the Northwest informs us that a convict spent his hours of leisure in a prison at Marquette, Mich., inventing a new air brake. Those who do not know anything about brakes say that this convict's invention is going to effect a revolution.

The Southern Pacific shops at Sacramento, Cal., are employing 215 men, a very much larger force than they have employed since the hard times came on.

Practical Letters from Practical Men.

All letters in this Department must have name of author attached.

A "Very" Local Train.

Editors:

The correspondence about delaying trains, conductors playing cards with station agents and similar features of "modern" railroading, recalls an actual occurrence on the little road which runs from Bethlehem to Bath, in Pennsylvania.

It was a one-horse affair then, and had only one engine, which made daily trips over the road, stopping wherever anyone wanted to get on, at crossroads or apologies for stations. One morning an old German woman stopped the train at a cross-road, but instead of getting on, she said, "I haf a leedle cow I want to sent mit Bethlehem." "Where is it?" inquired the trainmen, who didn't like to be delayed, even on a fourth-rate road.

"Oop in der field. I vant der fireman to help me catch dot leedle cow and take him mit Bethlehem."

This was a little beyond the limit of endurance, and the train went on; but the idea of stopping a train while the fireman chased a calf around a ten-acre lot, was too good to keep, and the fireman didn't hear the last of it for a long time.

I. B. Rich.

Camden, N. J.

Setting Valves by Sound.

Editors:

I have been reading the interesting articles of Mr. Rogers and Mr. Pitts on "Setting Valves by Sound." I have had considerable experience setting valves any old way, but have found setting by sound a poor practice—in fact, simply guesswork. I do not quite understand Mr. Pitts' method of getting forward motion square by back motion rod. If valves are not in cut-off, of course, if the reverse motion is out any considerable extent, it would affect the other motion, especially when working near center. I have set the valves of a number of engines that would not sound square in all points of cut-off, when I knew positively that all valve gear was correct; then in my search to find the difficulty, would stumble on a number of defects where the trouble was located.

Sometimes I would find the trouble in the ports or cavities of the cylinder; again, one cylinder a little different in chamber, or a cylinder head projecting over opening, or main rods not a correct length, compressing (if engine has cushion) the steam more in one end of cylinder than the other, creating a sharp exhaust. These defects just enumerated are scarcely noticeable in full gear, but when lever is cut back near center of quadrant, they show up pretty plain. A difference in the diameter of cylinders, I find, may be overcome by reducing the travel of valve on side with large cylinder. That means, to reduce the quantity of steam going to large cylinder to minimize the quantity to the amount required to produce an equal exhaust; this is also beneficial in regard to a weaving or jerky motion that is generally produced by a difference in diameter of cylinders. If Mr. Pitts was working with an engine with a difference in the diameter of cylinder, he might change his back motion rods until he wore them out, without producing any beneficial results. I could dwell at great length on experiments I have tried in setting valves by sound, tram or indicator, but will wait to see how I fare at the hands of the publishers.

John Jay.

Columbus, O.

Lilliputian Train.

Editors:

I herewith send you photograph of the Denver Short Line, which ran, by an engagement, at the St. Louis Fair, in October, and received a good patronage. It has three officers—a manager, engineer and agent. This line carries passengers, first in coal cars, and the round trip is a circle about 400 feet. Each car seats three children or two adults.

The photograph shows full train and load. The small engine alone, of which I give you the dimensions in detail: Hight from rail to top of stack, 21 inches; boiler diameter, 8 inches; cylinders, 1½ x 2½ inches; driving wheels, 8 inches; truck wheels, 3 inches; grate, 5½ x 7½ inches; gage, about 8 inches; wheel base, 5½ feet; total boiler pressure, 175 pounds; tender capacity, 6 gallons; boiler capacity, 5 gallons; weight of engine, 450 pounds. Built by J. W. Shriver (the engineer), of Denver, Col., and photographed by sender.

Theo C. Becke.

St. Louis, Mo.

LILLIPUTIAN TRAIN.

Awkward Engine to Repair.

Editors:

Having occasion, a short time ago to overhaul a small locomotive that was designed and built in a private shop, I was convinced, before finishing the job, that people who are not in the business had better let locomotive building very severely alone. The engine was of the four-wheel connected type, with pony truck front and back. The tank was located between the frames and in front of the smoke-box, and so close that it had to be removed, to do any work in the front end.

But this was not the worst combination about the machine. Between the top and bottom frames was a casting in which was incorporated the driving-brake cylinder, (pull-up) rocker box, reversing shaft bearing and bosses for holding the brake hangers. The brake cylinder had but one removable head—the top one. The reversing shaft had movable lifting arms, so the shaft could be slipped into its bearing on one side, then pushed over into the other bearing; the arms adjusted to suit the links, and keyed fast. To rebabbitt the rocker boxes and make the other repairs to this combination was what "Locomotive Engineering" calls "Ngxl," or "Yuma," which is the same.

The bosses for the brake hangers had broken off long ago, as they very properly should; to replace them, some mechanic had substituted wrought-iron ones, holding them in place with ⅝ bolts in ¾ holes. The cylinders were 9 x 14, but the links were of the cast-iron variety, and weighed, separately, without saddle or block, 38 pounds. Yes, they were heavy enough.

Included in the repairs of this engine were new driving brasses. The boxes had at some time been slotted out; but having no facilities for machining new brasses, and the work being in a hurry, I suggested to the molder to try casting the brasses in place. Being somewhat uneasy on the score of shrinkage, we tried one, and allowed the metal to flow into the old oil and plug holes. It made a surprisingly solid job. We cast the four brasses in place in less time than I could have fitted one brass in place by machinery, and I am convinced that brasses can be cast in place without any machine work, and ensure a good fit. Plugs can be driven or cast in place.

W. de Sanno.

Tulare, Cal.

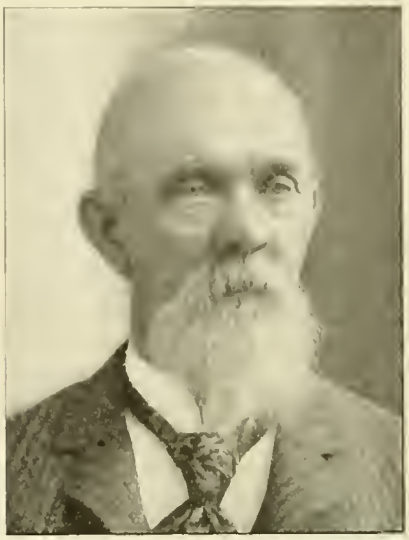
A Veteran Engineer and His Engine.

Editors:

We have on our line an engineer by the name of George Garrett, 78 years of age, who is at present running one of our Class L 69 engines, that are in service between Laramie and Cheyenne, Wyo., and who gives as good service as any of the younger men running same class of engine.

Thinking it may be of interest to the readers of "Locomotive Engineering," I send you herewith a history of his railway life, also a photo of himself and the engine he runs.

First commenced at the opening of the London & Northwestern Railway, at Camdentown, London, as assistant to machinist, where he remained for two years. Then went to Cardiff, South Wales, where he worked as machinist apprentice in the shops of the Tuff Vale Railway. After a few years in the shop, was put on the road firing, where he fired but a short time, when he was given an engine to run, switching on the wharfs of Bute Docks. This in 1843. From switch engine to road engine, between Cardiff and Merthyr Tydvil, and finally was given a run on an eight-mile branch, from Navigation House to Aberdare, making two trips a day, with three small coaches. Engine built by Norris & Co., Philadelphia—11-inch cylinder, single



VETERAN ENGINEER.

drivers, 80 pounds steam, and hook and hand-gear motion. Engine was named the W. F. Moorsom.

About 1847 he went to Ireland with some engines built by Bury, Curtis & Kennedy, of Liverpool, for the Great Southern & Western Railway, where he took an engine to run between Dublin and Cork, 166 miles. He remained there for twenty-four years, most of the time on the day mail train—a very important train.

He left for America in 1871, going direct to Omaha, Neb., where he secured a position as locomotive engineer, and was sent to Laramie, Wyo., where he has remained ever since as a road engineer, and takes his turn regularly, in all kinds of weather.

Following is the description of Engine 1607, the engine run by Mr. Garrett:

Cylinders—22 x 28 inches.

Diameter of driving wheels—51 inches.

Diameter of driving axle journals—8½ x 11 inches.

Main rod journal—5 x 7¾ inches.

Weight of engine, two gages of water—163,800 pounds.

Weight on drivers—141,600 pounds.

Weight of tender, coal and water—106,000 pounds.

Total weight of engine and tender in working order—271,000 pounds.

Outside diameter of smallest ring of boiler—72 inches.

Length of firebox—10 feet.

Grate surface—34.47 square feet.

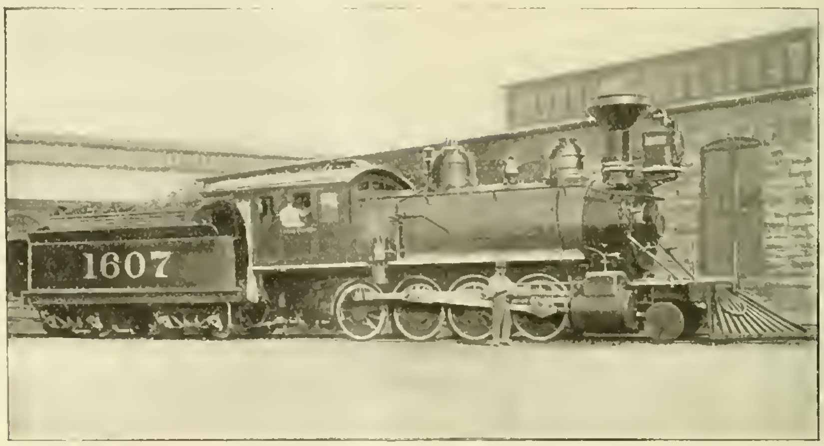
Two hundred and seventy 2¼-inch flues.

Total heating surface—2,313.7 square feet.

The grade runs as high as 106 feet on west side of hill, and 97 feet on east side of hill. Engines are rated at 1,400 tons on west side of hill, with an engine of same class pushing. Red Buttes to Sherman, 14.6 miles. Average time consumed Red Buttes to Sherman, 1 hour and 10 minutes. This rating runs from 40 to 48 loads, and is usually all air-brake cars. Sherman to Cheyenne is 32.7 miles, an average grade of 90 feet. Uncle George takes 40 to 50 loads down this grade as well as the younger enginemen, and always has plenty of air, and no trouble at all in any kind of weather; is always satisfied, and we never find him looking for trouble.

P. H. Stack,
Loco. Insp., Union Pacific Ry.

Omaha, Neb.



ENGINE RUN BY THE VETERAN.

Putting Animal Oil in Boilers.

Editors:

In issue of November I noticed answer to No. 83, G. C. C., Lowell, Mass., and would like to state my experience. I once forced one teaspoonful of valve oil through injector to boiler, and I had a time with that train. No engineer can run engine and pull train if there has been the least particle of any fatty substance blown into or placed in boiler. You said that oil went into boiler was improbable, but possible; and one thing is sure—the engineer going out on that engine would not have to ask where the oil went. My experience is, the oil went to the cylinders. Please do not think I am criticising your answer; only I thought it might lead some engineer to get in trouble, like I did, thinking valve oil would help his boiler out, and get left. We use crude oil in our boilers often.

W. A. Thompson.

El Dorado, Kan.

Eccentric Strap, Etc.

Editors:

When one of the bolts of the ordinary eccentric strap becomes loose, the opposite ear is almost always broken off by the heavy strain brought upon it. The amount of leverage will average about 8 to 1, and the amount of pull required to move the valve generally proves too much for the ear before the loose bolt is discovered, and if broken, the strap is practically spoiled.

Mr. Foster, of the Fall Brook Railway, many years ago recognized this defect, and increased the length of the ears, so that leverage was reduced to less than one-half of that of the ordinary form. From this it was only a step to put in the additional screw bolt, as shown at *A*, Fig. 1, and thus reduce the liability of breakage from this cause to a minimum. A large number are in daily use, and are giving good results.

Another kink is the form of rod strap used on the main and parallel rods. With the usual form the seat for the brass is planed of the same width as the stub end of the rod. When this seat becomes worn from loose brasses, it is necessary to rivet liners on the inside of strap to take up the wear.

Fig. 2 shows the form adopted, which has the seat slotted about 3-16 inch narrower than the stub end, thus giving plenty of material for wear and facilitating fitting and removal of brasses. Some straps in use have the same principle applied to the sides also.

Probably the simplest form of tumbling shaft turners in use has been rigged up by an ingenious mechanic. It being necessary to turn a shaft in a lathe of less than the required swing, the shaft was placed on the centers, and secured in position by two straddle chucks *C* and *D*, Fig. 3, which were bolted to the lathe carriage. The tail stock now being pulled back out of the way, the shaft was free to move with the carriage, and with its axis corresponding to that of the lathe. A peculiar bent tool *F* was bolted to the face plate, and the amount of cut regulated by tapping stub end of the tool with a hammer; the carriage carrying the shaft being fed as usual. This primitive rig has proved so successful that all the tumbling shafts are now turned in this manner, and as smoothly as can be desired, the parallelism of the bearings being assured by the fact that the shaft is chucked by its original centers. In shops where the straddle chucks are not available, two center rests of the right hight will answer every purpose.

Fred E. Rogers.

Corning, N. Y.

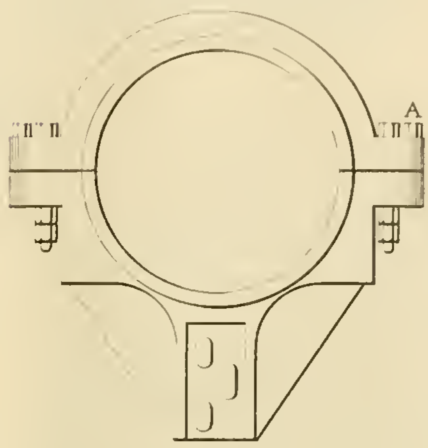


Fig. 1

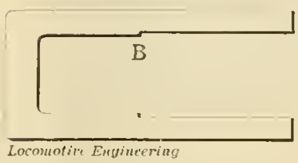


Fig. 2

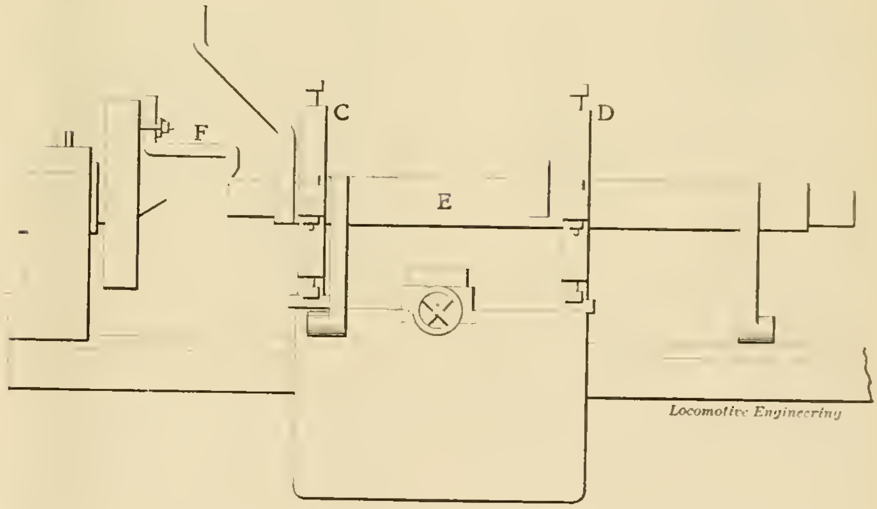


Fig. 3

The Proper Doctor for a Poor Steamer.

Editors:

"Engine does not steam"; there is a power of indefinite information conveyed in these four words, to the boiler shop or roundhouse foreman as he scrutinizes the engineer's report book of the necessary work to be done on his engine. This case is synonymous with the one of a physician being called and asked to prescribe for a sick man when he knows neither symptoms nor conditions. The doctor can no more prescribe intelligently until he has diagnosed the case, than can the boiler-maker make alterations suitable for the conditions of this engine failure. The trouble may be with the stomach of the man to properly assimilate the food he has eaten, or the engine to properly assimilate the fuel and secure from it all the nutriment and life-giving qualities to the heating surface of the boiler. There may be an obstruction in the bowels, or they may become astringent; likewise the flues of the engine—congestion may have been caused from bodily exposure of the man, and may be the result, on the part of the engine, of the lower half of the firebox sheets becoming exposed to cold, dead ashes, on account of carrying a heavy dead fire. The lungs of the man may breathe through diseased air passages; the engine may breathe through diseased dampers, grate bars or side bearings. It can now be seen that it is just as essential in the one case as in the other, that a careful diagnosis be made in reporting an engine not steaming, and note carefully the conditions and performance of the engine and advise intelligently as to the drafting of the engine.

How is this to be done? some will ask. There is only one correct way—handle the scoop. If you have a fireman who fires intelligently, carefully noting the placing of his coal upon the grates, and the result after putting it there, you can depend on him for proper information; but the man who handles the scoop is the only one who knows just what the fire is doing, and if a traveling engineer, fireman or fuel agent is desirous of ascertaining the trouble with any engine not steaming, let him callous his hands on the shovel, and not callous the seat box.

W. J. Torrance.

Evansville, Ind.

Louisville & Nashville Sander.

Editors:

Herewith we hand you blueprint of our pneumatic track sander. This is the very latest and only adjustable feed out. It works in all positions of engineer's brake valve, or not, as you like; is automatically closed; can't be forgotten, etc. We have had these in service for the past twelve months on this division of the Louisville & Nashville, and they have never been even looked at. There are also several sets on other divisions of this system giving entire satisfaction. Mr. Leeds, superintendent of motive power, says it is all right, and he will put them on. This

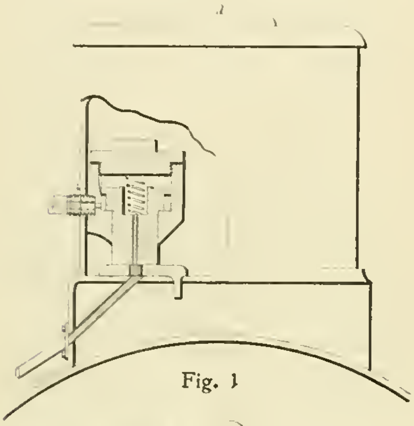


Fig. 1

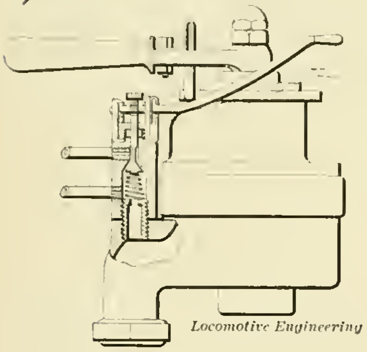


Fig. 2

arrangement retains old sand valves, to be used in case of a failure of air supply, and also uses the old valves as a cleaner for pneumatic valves; thus keeping both ready for service. It always applies full in emergency. We have just received an order from the N. C. & St. L. for trial set. We put them on any road wishing to try them, free of charge, and let them do their own talking. Have yet to find an engineer who is willing to exchange for any other kind.

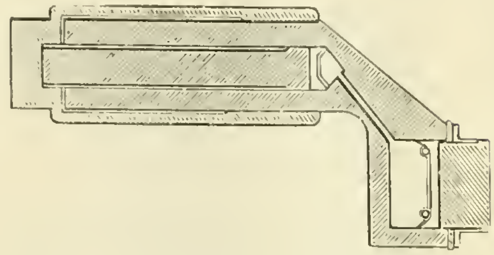
J. H. Watters,
Division M. M., L. & N. R. R.

Anniston, Ala.

Piston Rod Extractor.

Editors:

I send you a wood-cut of a piston rod extractor that I invented some three years ago, and have been using since that time, with marked success. I find the tool very strong, and to all appearance durable, and have used it to great advantage in removing bolts from frame and other parts of locomotive where we could not use a sledge or cannon. You will



observe that the tool is so made that it may be used in almost any form of crosshead. We have never found a piston that it would not remove readily.

C. E. Nichols.

Mandan, N. D.

"Setting Valves by Sound."

Editors:

A full reply to the questions asked by Mr. Pitts in the November "Locomotive Engineering," in regard to the adjustment of locomotive valves by sound, would require considerable space. But briefly as possible, the cause of the heavy exhaust coming on the back centers of a worn road engine is partially, as Mr. Pitts states, the wear of the shoes and boxes in a forward direction; but the larger part is generally due to the effect of the displacement of the valve stem.

The area of a stem 1¾ inches in diameter is 2⅖ square inches. This multiplied by pressure in the steam chest at 150 pounds gives 360 pounds steady push backward on the valve rod. The writer believes that a well-lubricated balanced valve on 16-inch ports will not require this amount of pull to move it when engine is under motion at slow speeds. At any rate, the valve motion parts have this additional resistance to overcome in forcing the valve ahead than when moving it back, so that all the working parts will be worn greater on the sides subjected to this resistance than on the sides opposite, and in a greater degree, proportionally, than with an unbalanced valve.

This wear has the effect of lengthening the distance between the eccentrics and the rocker pin, and to compensate for it, the eccentric rods require to be shortened.

Mr. Pitts will observe, if he carefully reads the letter in the October number, on page 749, that it states that *all* the rods are to be shortened an amount that will depend on the conditions found, also that lameness is supposed to be due to wear, and not to slipped rods. In this case both forward and backward rods should have the same length as when adjusted in the shops, and as the backward rod connections are likely to wear as much or more than the forward ones, owing to their catching more dust and grit, they will all require to be shortened practically the same amount.

Quoting from the former letter: "In case that an eccentric rod has slipped, replace it as near the original position as possible, and work engine in the corner in the direction indicated by rod slipped—as forward for forward-motion rod." If the backward rod was slipped, the engine should of course be worked in full backward gear. No practical valve setter would attempt to adjust valves in this manner without a thorough test in both directions; neither would he attempt to secure proper steam distribution by the distortion mentioned, as it is well known that the backward eccentric fills practically an equal position with the forward one. With eccentrics of the same advance, and with the link hooked up on the center, the motion of the rocker is due equally to both eccentrics, and is nearly equal to a crank whose length is equivalent to the linear advance plus the increase of lead, and its radial line lies in the same plane of revolution as that of the main crank pin.

An explanation of the lack of the sharp exhaust characteristic of an engine fresh from the shop seems hardly necessary, as no valve motion with 1-16 of an inch lost motion in the valve yokes, and double that, or more, in the links and connections, could hardly be expected to fulfill its functions properly. The wonder of it is, how some of the scrap heaps running to-day are able to get over the road at all.

The writer has not attempted to give a full explanation of this subject, and any practical man who has had experience in this work knows that it is at times a very tricky and unsatisfactory business.

Fred E. Rogers.

Corning, N. Y.

When the Wabash Company opened their new Chicago-Buffalo line, they took the position that they could not afford to discriminate between their Eastern and Western lines in the matter of free reclining chair cars, and at once began running these cars on the new line between Chicago and Buffalo and New York. There was a vigorous protest from the Eastern competitors of the Wabash against this innovation, but Wabash officials continued running the cars. Then certain of the Eastern lines took the matter up with the Joint Traffic Association, with the view of compelling the Wabash to withdraw the through chair car service. The board of managers have now announced that they have stricken the subject from the docket, thus practically deciding that the Wabash has the right to operate these cars on all portions of its lines.

Welding Copper.

Messrs. Wyman & Gordon, of Worcester, Mass., have been studying the question of welding copper, and have devised special machinery for this purpose which does not require the use of electricity.

The expense of fitting up for each weld is such that it is not advisable to use it except where large lots of the same shape are to be welded. They very naturally do not care to make the process public, but the fact that copper can be welded without electricity is of interest to mechanics generally.

Chip Made by Pneumatic Tool.

The annexed engraving is taken from a photograph of a chip cut out of a plate belonging to one of the Japanese cruisers under construction at Cramps' shipyard in Philadelphia. The cut was made with one of the Chicago pneumatic tools, and was done at the rate of three inches per minute.

The engraving gives a striking idea of the tremendous power possessed by these pneumatic tools. Cramps' people have a great many of the tools in use, and all other ship building firms are equipping their yards with the chipping tools as fast as they can get them into service.

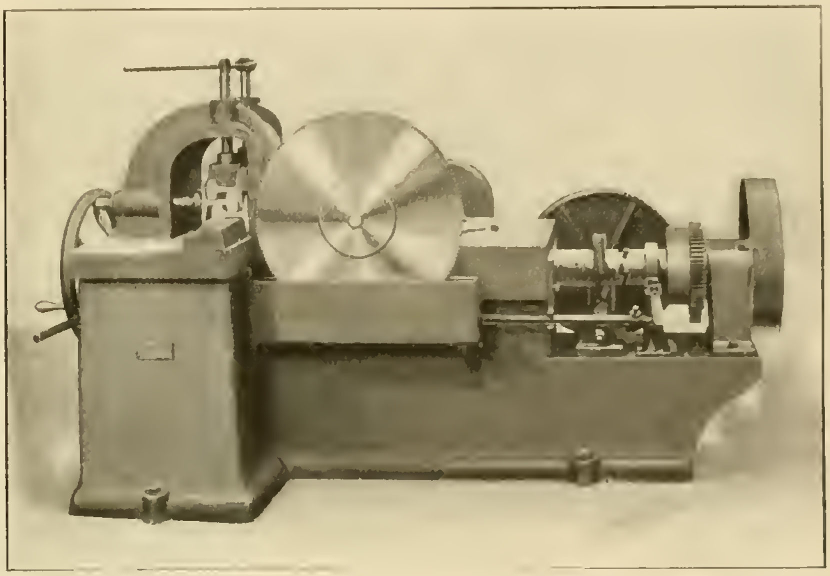
CHIP MADE WITH PNEUMATIC CHIPPING TOOL.

The works of the Chicago Pneumatic Tool Company are working day and night and are away behind on their orders. The orders are said to average about twelve machines per day. President Duntley has been traveling in the East for several weeks, and finds the outlook for business to be away beyond any expectations he ever entertained. He has opened offices in the Baird Building, 122 Liberty Street, New York, where his tools can be seen at work at any time. Mr. Duntley wishes us to say that he would like to have railroad men interested in pneumatic tools pay them a visit, so that they can see for themselves what the appliances are good for.

Rail Cutting-off Machine.

The special cold saw cutting off machine, hereby shown, has been designed for cutting off the ends of old rails where they are worn at the ends for re-laying on side tracks or small divisions.

The tool is a No. 3 bar cold saw cutting-off machine, has a saw 24 inches in diameter, and the work table is provided with a special clamp for holding three rails at one time. With this system of cutting, three rails can be cut off almost as quickly as one, and is adapted to the heavy handling necessary where it is used for this work. The machine has a variable feed which is controlled by a lever and a power quick return. Many of these machines which are sold are placed in positions where it is not convenient to apply power to them and are driven with a direct coupled electric motor. All the main gearing of the machine is of steel and the worm of phosphor bronze with a hardened steel wheel. The machine is made by the Newton Machine Tool Works, Philadelphia.



NEWTON CUTTING-OFF MACHINE.

The improvements on the main line of the Baltimore & Ohio, west of and between Martinsburg, W. Va., and North Mountain, were completed November 1st. They cover a distance of nearly four miles, starting three miles west of Martinsburg and extending some distance west of Myers Hole, which is near the North Mountain station. At Myers Hole the line was changed, taking out some very objectionable curvature, and the roadbed raised nearly 15 feet, eliminating two grades of 42 feet per mile, which came together at Myers Hole, and substituting therefor an almost level track. This point on the road has always been a dangerous one, and many freight wrecks have occurred there. Apart from doing away with the dangerous feature of two sharp down grades coming together, as was the case in this instance, the saving in operation of the road by the change will be very large, as it enables the tons per train to be greatly increased, and reduces the liability to accident to the minimum.

The Michigan Central people are renumbering all the locomotives belonging to the road, and arranging them so that the numbers of each class go together. It is a stupendous job, as the classes of engines have been mixed up rather promiscuously. We do not envy the roundhouse foreman of their shops for the next three months. We know of nothing which embarrasses a roundhouse foreman so much as changing the numbers of engines. He gets to identify an engine by its number in the same way as he identifies a man by his name, and the work of attaching a new identity to each is very tiresome.

We are not sure as to the largest number of patents ever issued to one man at the same time, but venture to guess that Mr. Milo G. Kellogg, of Chicago, comes pretty near breaking the record, whatever it is. On October 26th he was granted no less than 124 separate patents, occupying 141 pages of the "Patent Office Gazette." This represents a nice little sum of money, both for the Government and the Patent Attorney.

The machinery in the United States Rolling Stock Company's works at Decatur, Ala., has been moved to the company's works at Anniston. The citizens of Decatur do not like the change, and they are doing some very vigorous kicking.

Railroading with the Confederacy.

BY CARTER S. ANDERSON.

October 13, 1897.

The Kilpatrick-Dahlgren raid, February 29, 1864, in sight of the Confederate capital, and between it and the main army of defense, being entirely unexpected and unannounced by even the firing of a gun, was, to the military and citizens of this part of Virginia, the greatest surprise of the war. On March 1st, when General Kilpatrick crossed the South Anna River at Blunt's Bridge, twenty-five miles from Richmond—and about which I will write later—had he gone directly towards Richmond, instead of going around to the east of Richmond, he could very probably have taken the city easily. For, by doing this, he could have reached there and made the attack on the Brook Road at the same time that Col. Dahlgren did on the Westham Road, and before Gen. Hampton, who was in his pursuit, could have overtaken him. But anyone can see it all after it is over!

This raid awoke from winter's lethargy not only the peaceful citizens, but also aroused the dogs of war, and put in action both armies, which, up to this time, had been wintering on their respective sides of the Rappahannock River. Gen. Grant assumed command a fortnight after the time of which I write, and soon after fought with Lee the historic battles of the Wilderness, Spottsylvania, North Anna River, Hanoverton, and last, but by no means least, the bloody battle of Cold Harbor, which, in my humble opinion, was the most severe repulse Gen. Grant ever had.

I was a prisoner at Gen. Grant's headquarters, a short distance from the battlefield, on the evening of the last great battle at Cold Harbor, and I formed this opinion from what I saw and heard from the soldiers around "Bull Ring," as they called the place where we were under guard. Such significant orders as these were given: "No lights!" "No fires!" "No loud talking!" "If there is any demonstration among the prisoners, the camp will be shelled!" "Place the cannon to bear on camp," etc. No so-called coffee was made that night in our tin cans, but in silence we nibbled our hard tack. One of my fellow-prisoners having in his possession a small piece of meat, and overcome by the desire for the flesh-pots of Egypt, had raked a few coals of fire together, and was essaying to make unto himself a little savory stew, in which his soul delighted. He was complacently stirring the concoction and humming to himself in sweet anticipation, when a guard came quietly by, with a gentle movement of his foot he kicked over the stew, and firmly crushed out the coals. Not a word was said on either side. It was the "sublime eloquence of an act." Words would have been idle!

Very early the next morning, Gen. Grant moved rapidly his army under cover of his gunboats at West Point, on the York River. History, however, tells this.

I will now go back and, as I started to do, show to the reader Gen. Kilpatrick as he, with 5,000 troopers, approached Anderson's Ford, on the North Anna River, about two miles from Beaver Dam Depot, on the Virginia Central (now Chesapeake & Ohio) Road, while Col. Dahlgren, with less than 500 men, crossed the North Anna ten miles higher up the river, opposite Frederick's Hall Depot, on the Virginia Central Railroad. Gen. Kilpatrick struck the Virginia Central Railroad at Terrell's Crossing, about 1½ miles east of Beaver Dam depot, where he came very near capturing the train of which I was conductor, and of which I will presently tell. He did no harm to the railroad track. I will here remark that these raiders did no harm to property; they took, as they went, the slaves and horses; but they did not tear up and destroy track, as Gen. Sheridan invariably did.

From Terrell's crossing Gen. Kilpatrick went across the country to Little River, encamping for the night on Col. Fontaine's farm, called "Colley Swamp." Then crossing Little River at Honeyman's Bridge and the South Anna at Blunt's Bridge he went in the direction of Atlee, on Virginia Central Railroad, northeast of Richmond. He encamped near Atlee on the night of March 1, 1864, and was attacked during the night by Gen. Hampton, routed, and made his way back to the Federal lines the next day. Col Dahlgren crossed the Virginia Central Railroad about 2½ miles east of Frederick's Hall, at Gunnel's and Coat's crossing. His men were in two squads. They captured a court-martial which was in session in an old house on Addison Coat's farm, mounted them on Mrs. Holladay's horses and struck out for Dover Mills, on the James River, crossing the South Anna at Car's Mill. Finding that he could not ford James River at Dover Mills, as it seems he had been informed by his guide, Col. Dahlgren took the mountain road north of James River and pushed on towards Richmond, approaching the capital on the evening of March 1st via the Westham road. When a few miles from the city he met the Local Defense Troops and fought the sharp battle of Glenburnie. In passing, will say that the Local Defense Troops were composed of employés of the Tredegar Iron Works, the armories, the railroad men, department clerks, etc. Before this little battle our Local Defense Brigade, under command of Gen. Custis Lee, was the laughing stock of the army. Many funny predictions were made by both military and citizens as to what would happen were these defenders forced into a fight. But this battle placed our Local Defense corps alongside the gallant boys who wore the gray. One drawback to our Local Defense Brigade was their proximity to Richmond and the accessibility which the boys had to a city's many temptations, attractions and snares. To resume, after this battle of Glenburnie Col. Dahlgren evidently decided to get back into the Union lines, as Gen. Kilpatrick had failed to signal him. Col. Dahlgren came out on the Brook road and crossed the Virginia Central at Peake Station, and crossed the Pamunky River at Hanoverton.

Having given in dry facts an outline of the raid as a military movement, I return to my narrative. On the day that Gen. Kilpatrick was approaching the North Anna River at Anderson's Ford, opposite Beaver Dam, on the Virginia Central Railroad, Dr. Charles J. Terrell, a Confederate surgeon, and G. N. Thompson, a Confederate cavalryman, both of whom lived near Beaver Dam, and who were then at home on a furlough, had agreed to go across the river into Caroline County to take a hunt, intending to cross at Anderson's Ford. At 2.30 P. M. on the same day, Feb. 29, 1864, I left Richmond for Gordonsville with the afternoon passenger train, consisting of one baggage car, one express car and three passenger coaches. The engine was E. Fontaine, built by Norris & Son, 1854. It had four drivers, 60-inch diameter, and was run by Engineer James Ramsey. (This engine exploded at Wickham's Station Nov. 14, 1864, instantly killing James Ramsey and an unknown soldier, who had just flagged the train to get on, and was struck when just opposite the exploding engine.) The train was crowded, as was every train during the war, with citizens, soldiers, sutlers, etc. The E. Fontaine was a fairly good passenger engine for those days, and James Ramsey not a timid driver. As we dashed along through Hanover County that afternoon we had as little idea of what a dangerous trap was then set for us to fall into as did Dr. Charles Terrell and "Galley" Thompson of the fun in store for them. They were riding along towards Anderson's Ford. Mr. Thompson, familiarly known as "Galley" Thompson, was ahead, and had just been talking over his shoulder to Dr. Terrell, telling him what a narrow escape he had once made from being captured. As they aproached the river he threw the reins on the horse's neck to let him drink. At that instant Kilpatrick's men, who happened to ride up on the opposite side of the river, covered him with their guns and called: "Surrender!" "Galley" had always dreaded being captured, and so surprised and startled was he that he dashed his loaded gun over his head into the river, and cried: "The damn Yankees have got me at last!" The men then took him in charge, and carried him along near his own home. Seeing a neighbor, "Galley" called out regardless of the personality of his remarks: "Tate.

tell Lucy Ann (his wife) the damn Yankees have got me, but I'll be home to dinner to-morrow!" Sure enough that night he dug himself out of a tobacco house where he had been imprisoned and got home the next day to dinner!

Dr. Terrell was far enough behind Mr. Thompson to take in the situation at the river, and to save himself. He retreated in good order, going back by Beaver Dam, notifying them and hurrying home near Terrell's crossing, he put one of his servant boys on his finest horse to reconnoitre and report to him the situation of the enemy. He never again saw horse or rider. Meanwhile, he had another boy "hook up" the oxen and haul the meat into the woods. "Save your bacon," was, literally "first in the hearts of our countrymen"—and women, too—whenever we heard of a raid. Dr. Terrell was hurrying the boy and oxen along, so as to get the bacon safe and in a hidden place before he left the house, when he heard my train coming at Hewlett's, a station three miles off. He realized that we would be captured or killed if we went on, so he determined to try to notify us of the danger. Accordingly, he left everything to the care of his wife, and started out for the track. He ran down it some distance, hat in hand, and waved us down. Ramsey, seeing him, called sharply three times for brakes, which meant trouble, so out of the window popped every head, to learn the cause of the signal. We then saw Dr. Terrell running up and waving. We wondered what the trouble could be. "What's the matter, Doctor?" we called out, as he, exhausted, came up to us. He answered at once, "The Yankees! They are between here and Beaver Dam. I saw them not a half an hour ago myself. They are certainly trying to capture your train, for I heard the cavalry riding rapidly down the country road. They are riding towards Hewlett's in your rear, to cut you off." He begged us to run back as quickly as possible, warning us that we would otherwise certainly be captured very soon. Turning quickly to Ramsey, I said, "Jim, what's best?" "Cap'n," said Ramsey, coolly, "I'll do anything you say; but damn if *I* believe there's a Yankee this side of the Rappahannock River!" The Doctor again assured us that he had seen them himself; but, he added, "You'll soon see!" Hotly discussing the matter, we walked a little way up the track towards where the enemy was supposed to be, turned the curve in the track and, emerging from the cut and the woods, got a view of about half a mile across the field. The discussion then ended. We saw the dismounted cavalry coming in line out of the woods on opposite side of the field. They caught sight of us, and as their bullets began to sing that short-metre tune, Dr. Terrell said, "Ramsey, are there any Yankees this side of the Rappahannock?" "Yes," answered he, "and if we don't get away from here, we will be on the other side of Rappa*hell*ock!" We thanked Dr. Terrell for saving us, and telling him to take care of himself, we left him to his fate, as he declined our invitation to join us. Never was "Get aboard" said more hurriedly nor obeyed more promptly than then. More quickly than I can write it, we were under full swing, running backward, regardless of all rules to the contrary, almost as fast as the engine could turn her wheels. I ran back through the train with my negro brakeman, Daniel, and in this reversed condition of our train, he and I took the respective positions of fireman and engineer. Watching out ahead, we ran out into a field

DR. TERRELL, A CONFEDERATE HERO.

where the country road runs parallel to the railroad a distance of about half a mile from the track. We saw this road full of cavalry officers, who were riding at full sweep. We naturally took them for the enemy, and as they were ahead of us, we feared they would make the Hewlett's crossing first. The passengers took in the situation and got down between the seats, giving the inside of the train the appearance of the Methodist churches during prayers, fifty years ago. (They don't get down that way nowadays. Too upright!) Brakeman Daniel hung down from the bottom step of the car, on opposite side from the cavalry. He kept looking back under the coach, apparently at the truck. I feared rapid running had broken something, so I called out, "What's the matter, Daniel?" I soon understood, however. It was a case of not loving the truck less, but Daniel more, for he was bringing the coach timber to bear between his body and the enemy's bullets. We had to stop at Noel for water, and as we were then four miles from the enemy, as last seen, we ran curves a little less recklessly. Soon reaching R. F & P. Junction, we wired report to Richmond. We got orders to "Shift train and come to Richmond. Road is clear. Dead-head all passengers with tickets west of Hewlett's." We afterwards learned that the cavalry whom we raced were the Maryland Cavalry, like ourselves, on a stampede!

Referring once more to our friend, the kind Doctor. After seeing us safely on our way to our train he started on his way home through the woods. Just as he was about to jump the fence which let him into the main road a soldier rose up and met him. Dr. Terrell had the advantage, having his pistol well in hand. He raised it, aimed and was about to fire when the soldier threw up his hands. "Friend!" said he. "Open that Yankee overcoat, then," said the Doctor. "Ah!" continued he, "the Maryland line?" "Yes," replied the soldier, and "the glad hand" was given by the Doctor, who took his captured friend home with him.

The fastest time ever made undoubtedly is not on record. It was when a cavalry man on a Government horse heard the word "Go!" and knew the prize to be his life. Watching him at a distance and his pursuers in sight made the horse appear like the little tin horses the boys have, with their legs out straight before and behind. One peculiar thing a retreating cavalry man would do was to stop and shut a gate and put a peg or gravel in the lath. If he could do that and get his distance before his pursuers got to the gate he was all right. If the curses of Federal cavalry on those gate-latches that "push down" instead of "lift up" had "come home to roost" the gates all through the North would never move. Naturally, every Federal soldier thought the latch must be lifted, and when after tugging and cursing he discovered that the latch needed only a light touch downward to open the gate his game had flown.

On the evening of the raid we lost no time in obeying orders to come on to Richmond, stopping only at Hanover Court-House to notify the people there. My young wife was then boarding near there, and I sent her word I would be home some way just as soon as I got rid of my train. Whether or not our report from the junction was the first report which the War Department received of the raid, I am not prepared to say. But it probably was from the fact that Gen. Hampton, who was then encamped at Bowling Green, Caroline County, started in pursuit of Gen. Kilpatrick about mid night of February 29th.

Fulfilling my promise to my wife, I was at Hanover Court-House the next morning by 9 o'clock, having gone up on an extra passenger train which left Richmond on the time of the regular train to accommodate some Hanover people and some military, who wanted to get information in regard to the raid. The train remained only long enough to catch up some cars that were at Hanover and load on what provisions could be gotten, and return to Richmond. Just as soon as the train left for Richmond there came over old Hanover Court-House that awful stillness, indescribable, which prevailed wherever a raid was anticipated. Every sound heard and every horseman seen approaching, in our imagination, was the forerunner of Kilpatrick. There was nothing to prevent his coming to Hanover, and we all expected him.

But this letter is already too long. In my next letter I will attempt to tell whether or not and how our expectations at Hanover Court-House were realized; of Hampton's attack upon Kilpatrick at Atlee late at night; of the meeting of Col. Dahlgren with Dr. Thomas E. Williams, a Confederate surgeon, who had the Federal wounded in charge, etc., etc.

"Blistered the Rails" is the caption used by an Associated Press reporter in wiring particulars of the first run made by the new express train of the Lake Shore. The reported blistering was done on the New York Central tracks, between Utica and Syracuse, when a distance of 54 miles was covered in 59½ minutes. It seems to us that we have seen speed of a much more blistering character than this performed in that region by other trains. But "Blistered the Rails" is a catchy caption.

Pioneer of Pacific Coast.

The old switching locomotive here shown is a historical engine, since it was probably the first locomotive built west of the Rocky Mountains. It was built before the war by H. J. Booth & Co., of San Francisco for the Black Diamond Coal Company, and named "D. O. Mills," after one of the stockholders of the company.

For years the engine was used pulling cars between the Sacramento River and the company's mines at Mt. Diablo. In the fall of 1888, it was purchased by the Bellingham Bay & British Columbia Railroad, and by them rebuilt, and is now doing switching work for the same company at their saw mills.

The engine has cylinders 12 x 18 inches, and drivers 38 inches in diameter. Mr. M. F. Jukes, who kindly sent us the photograph and account of the engine, wishes us to ask if any of our readers can give particulars about this early locomotive.

PIONEER OF THE PACIFIC COAST.

The Baltimore & Ohio Southwestern Railway has been experimenting with electric motors on turn-tables. Turning locomotives at divisional points and terminals is a service of much annoyance and no little expense to railroad companies. It generally takes four men to turn a locomotive, and while they are doing so their regular work is abandoned. Experiments were made with an electric motor on the 60-foot turn-table at Chillicothe with such success that the Park street turn-table in Cincinnati was similarly equipped. The result has been rather astonishing in the matter of expense. The current was purchased from the power plant, and it cost on an average of less than one-half a cent for each time the table was turned. When this same table was operated by hand, it cost 12 cents for each engine. The yearly saving is about $709.

During the period of depression of business from which the country seems to be emerging, the locomotive builders kept up their establishments at a loss and sold locomotives to railroad companies below cost. Since a somewhat active demand for locomotives arose, the builders have been trying to raise prices to a paying basis, and some of the railroad companies in need of new motive power are threatening to build the engines in their own shops. We notice that two or three of the railroad companies have met the proposed rise in prices with this threat. The main shops of all the roads that want to build their own locomotives are noted for inferior tools and poor facilities for doing even decent repair work. They will better reconsider the question, if the companies are not prepared to put in a plant similar to that of the Pennsylvania at Juniata. Past expensive experience ought to warn railroad companies against the foolishness of building their own locomotives.

The Mechanical Engineering Department of Columbia College, New York City, is branching out in a determined manner under the guidance of Prof. F. R. Hutton, whose aim is to make the laboratories under his charge second to none in this country. The hydraulic equipment is one of the best—a present from the Worthingtons—and is an index of what is still to come, and what well-directed push can accomplish with brains behind it. Locomotive engineering is now receiving attention, with the object in view of a plant that will have every facility for testing and experimenting with a locomotive, as is done at Purdue University. This move ought to, and we are sure that it will meet with success. The friends of Columbia will see to that.

We rarely weary our readers by printing the nice things said about "Locomotive Engineering" by its numerous friends, but we will make an exception in regard to some kind words said in a recent letter by Mr. A. E. Beattie, locomotive superintendent of the New Zealand Railways, at Addington, N. Z. Mr. Beattie wrote: "May I congratulate you on the steady improvement in 'Locomotive Engineering'? To us out here it is most useful and interesting, and I think is considerably increasing in New Zealand circulation."

A report recently made by a United States consul in Belgium says that there are at least 10,000 dogs used as beasts of burden in Brussels.

Car Department.

CONDUCTED BY O. H. REYNOLDS.

Subscribers who bind or file the year's volume of "Locomotive Engineering," and wish to use an index for reference, can obtain one by applying to this office.

Combination Freight Car.

The car body shown herewith in elevation and sections is one capable of transformation from a carrier for the transportation of stock to one of the tight box type for merchandise. It is intended to reduce the probabilities of a car famine on roads of meager rolling equipment, and thus make a car a paying factor in both directions of haul by doing away with empties. This, it is claimed by the inventor, Mr. Stephen Dunn, can be accomplished by reason of the diversity of traffic in which the car can be used.

Framing substantially the same as in the ordinary stock car is shown in Fig. 1, in which the end at the right of the elevation represents the car open as used for a stock car, while the end at the left is tight, as transformed into a box car. In all essentials the cars is built for stock transportation, and therefore has all modern facilities for feeding and watering while in transit. The water tank and trough and hay racks are shown in the sectional view, Fig. 3, in which these details are in position for use on the right half of the section, and folded up to the car roof in the left half, the latter side showing the car adapted for box-car service with the side and end closed.

In effecting the transformation from stock service to box, the inside lining of the car is made so as to fold in sections from the corner posts to side door posts. This is shown at *A* and *B*, in Fig. 3, for that portion of the sides below the girths. To fill the panels above the girths there are hinged sections made to turn from the end of car and extend to door posts, as shown in Fig. 2, a horizontal section of the whole car above the girths, folded and forming continuous sides by covering the space between girth and plate, shown at *C*. These sides are shown folded at *D*, in Fig. 5. Fig. 7 is the lock for sides when folded at the end of car.

There are two sets of doors at the sides and ends; the solid doors being on the outside and covering the grated doors, each traveling on a separate track. The lower-end door at *E* is also double, as shown in Fig. 6. The door *F* is made to swing from the roof to cover the space left to introduce hay in the hay rack and prevent feed taking fire. All details to make a combination of cars covering general freight traffic, have been covered in the claims of the inventor. There is one object aimed at in this invention that will fall short of realization, in our opinion—that is, the production of a car for alternate use in the transportation of stock and fruit. There is a wide gap between cars for these respective purposes, and no matter how elastic the claims of the inventor, a single test of a well-saturated stock car for fruit or wheat haulage will be like the bright dream in Marco Bozzaris—the last. The toothsome pippin or succulent banana, we opine, would be too highly flavored, entirely too gamey for the ordinary palate; this fact does not detract, however, from the value of the car as to the other claims made for it, and we have no doubt that it can be made to cover the field intended by the inventor, aside from the cases noted above.

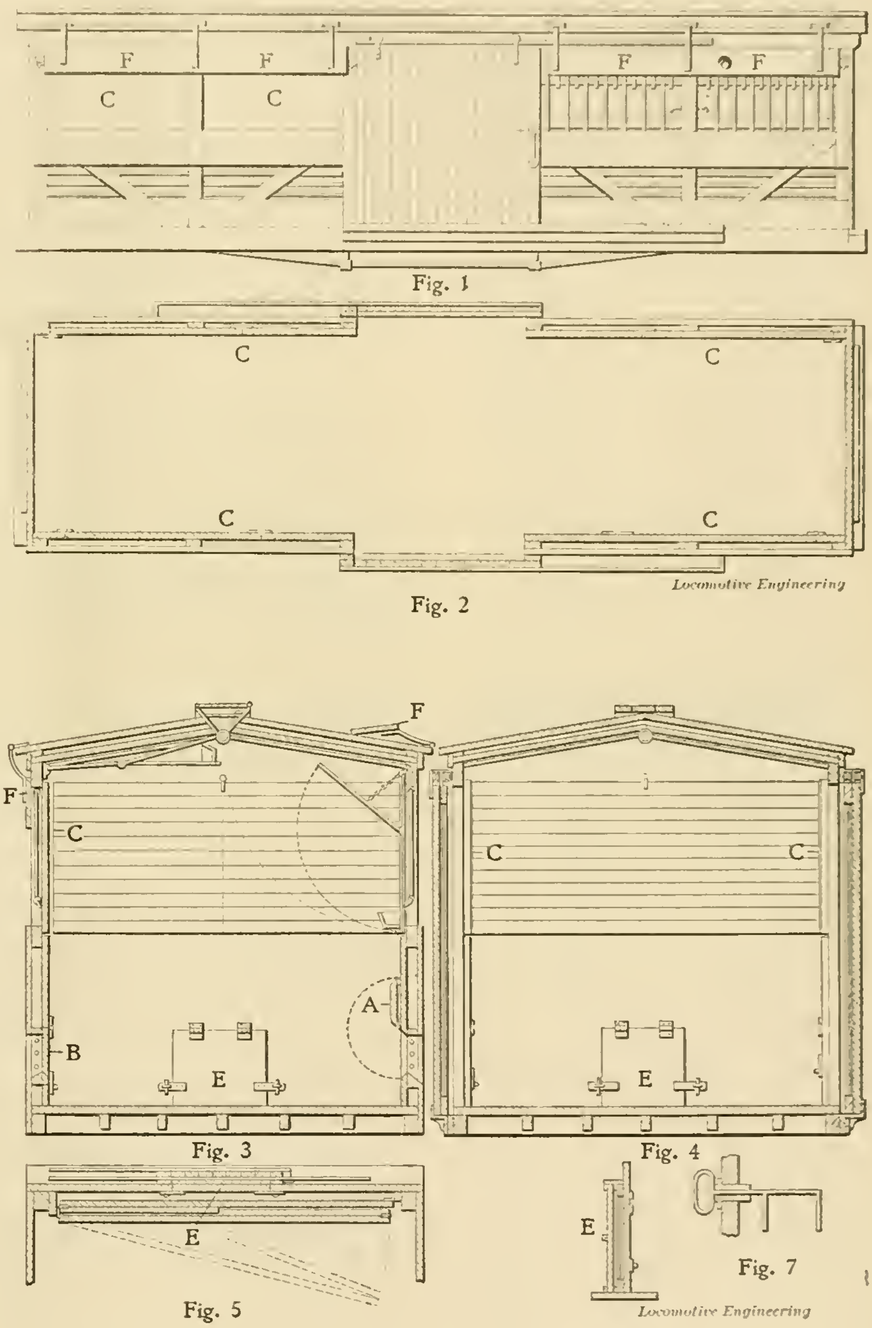


Fig. 1 Fig. 2 Fig. 3 Fig. 4 Fig. 5 Fig. 6 Fig. 7

COMBINATION FREIGHT CAR.

80,000-Pound Coke Car—Buffalo, Rochester & Pittsburgh Railway.

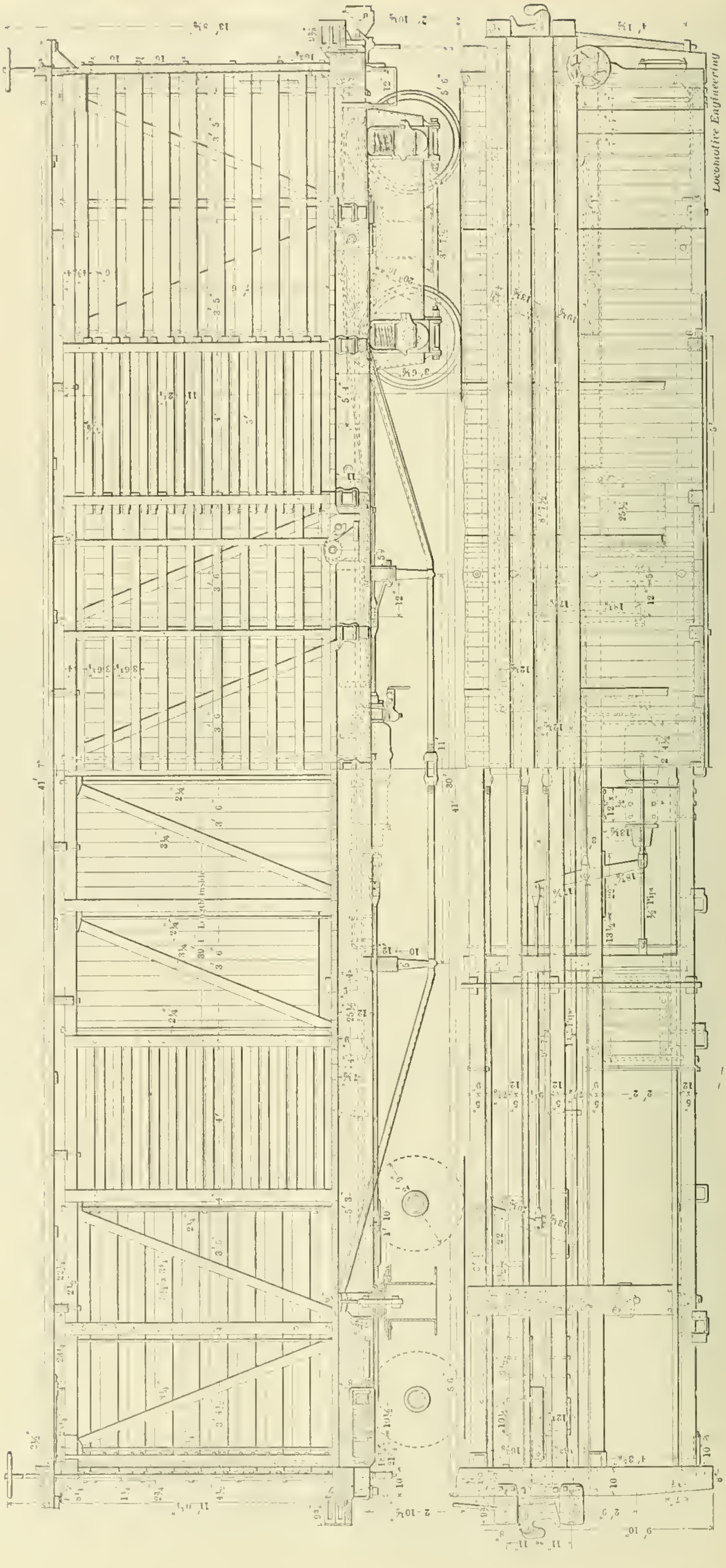
A coke car pure and simple, or one built for and devoted to coke service exclusively, while not as "rare as a day in June," still is not so plentiful as to excite comment, and the same must be said of the 80,000-pound car designed by Superintendent of Motive Power Turner, of the Buffalo, Rochester & Pittsburgh Railway.

This car is 41 feet long over end sills, 8 feet 11 inches wide over side sills, and 7 feet 6 inches from top of floor to under side of plate, which dimensions place it in the ranks of the big ones. The construction is of the open-work order, with the side posts carried in pockets similar to gondola car practice. Braces are held at the bottom in a casting made in combination with the post pockets, and at the top they fit in a cast shoe.

The superstructure, while strong and perfectly adapted to confine and carry the load, is in nowise built to sustain it, nor assist the lower frame in so doing; it simply forms a slatted box of a capacity for the required load, or about 2,800 cubic feet. Six truss rods 1¾ inches diameter, with ends enlarged to 2 inches in diameter, are used to hold up against the load, with the slight assistance of six sills. The rods have a drop of 31 inches at the center panel, and that means a fiber stress within safe and reasonable limits.

In keeping with the open idea, the car has no roof covering, aside from the running board, which is 31 inches wide, resting on cross-ties, 2½ x 4½ inches, tenoned into the plate, and alternate strips of 1¼ by 4 inch pieces gained into the plates. The floor is pierced for four drop doors, two at each side, near the cross-tie timbers, and between the outside and intermediate sills; these doors are operated by the usual shaft and chain, with ratchet and pawl attachments. The dimensions and disposition of the longitudinal sills have evidently been chosen with the view of having a body bolster that would be equal to the duty imposed on it. A depth of 12 inches at the outside and center sills, and 9 inches at the intermediate sills, together with the distance of 45 inches outside of the latter sills, allows of a double plate bolster of an exceptional strength and rigidity, by passing the intermediate sills through between plates without reduction of the wood, thus giving a depth of bolster of 13½ inches for a distance of 22½ inches each side of the center line. Both members of the bolster pass over and under the sills, respectively, and have malleable-iron fillers between the plates.

Malleable iron enters largely into the details of the car, as is the practice of this road for all freight equipment. Fox trucks are used in these cars. A brake staff is at each end, notwithstanding the car is fitted with air. Designed, as it is, for a special traffic, there will be found



BUFFALO, ROCHESTER & PITTSBURGH 80,000-POUND CAR.

little wanting to make the car abreast of the best there is in car construction. The engraving shows no back-number schemes furbished up for duty—all points are thoroughly in line with advanced car practice, and reflect credit on all concerned in its production.

The Car Window as a Means of Escape.

The exact status of the coach window has not, to our knowledge, been clearly defined. If it were ranked among the necessities for light, as was no doubt the intent when first placed in a car, and used for that purpose only, its function would be plain. If used simply as a ventilator to satisfy the whims of the crank that must have air, then we know where to class it. If, in addition to these uses, it is made the means of exit in case of derailment, the matter begins to assume a different aspect, and we see the window as a life-saving device.

There are, however, objections to the use of a window for the escape of surviving passengers in case of wreck, among which may be cited the difficulty of getting through broken glass without serious injury, and also the futility of an attempt to escape by that channel from a submerged car, or from one suffering from the ravages of the fire fiend. All of these contingencies call for the promptest action to save life, and a consideration of them should receive the attention their importance calls for.

This view of the situation was taken several years ago by members of the New York Railroad Club, and interest was awakened in the matter of making egress from a wrecked car safer and surer than by the windows, which were too often the only avenues of escape. The movement, after considerable discussion of the best means to reach the end sought, crystallized into drawings of a trap door in the roof of a passenger car, the trap so constructed as to open easily and quickly from within. The scheme never got beyond the recommendation period, but the members of the club have the satisfaction of having contributed their influence and talent in the direction of the amelioration of a situation that appeals to man's best nature. Unfortunately, there is nothing on record to show how the idea was actually worked out, for the reason that the action referred to occurred in the early days of the club, and before proceedings were published.

If the necessity for action was apparent in those days before the vestibule was a component part of a passenger train, it would seem that the time was ripe for a new agitation, since a locked vestibule serves nicely to close up the means of escape from a train in a smash. Something ought to be done to make cars less rat-trappy for passengers in time of peril.

Growing Demand for Pressed Steel Cars.

In July last we announced that the Pittsburgh, Bessemer & Lake Erie Railroad had placed an order with the Schoen Pressed Steel Company, of Allegheny, for 600 steel cars of 50 tons capacity. We now learn that within the month the order has been increased to 1,000 cars. The builders have been rather slow in finishing the first order, owing to the difficulty of providing the special machinery necessary for the building of this new type of car; but they are now getting along with the work very rapidly. We learn from a member of the firm that when they get their works in proper running order, that a steel car of a given capacity will be built as cheaply as a wooden car. As the durability of these cars is going to be five or six times greater than that of wooden cars, railroad companies are likely to lose little time in patronizing the superior type of rolling stock. The fiat has gone forth that the wooden car must go. The machinist and boiler maker are pushing the carpenter to the wall.

Efforts are being made to have the car works at West Duluth, Minn., put into operation during the coming winter. These car works, which contain first-class machinery for the construction of cars, have been standing idle for several years, and have done very little work since they were built. The activity of business in the ore regions encourages those interested in the works spoken of to believe that sufficient repairing of cars and building of new ones can now be secured to keep the works going.

Memphis, Tenn., reports that the city and district are suffering from a freight-car famine. Those interested do not appear to take the inconvenience very seriously to heart, for they argue that Memphis is the only city in the South that is suffering from car famine, and therefore Memphis must be one of the most important railroad centers.

The West Milwaukee shops of the Chicago, Milwaukee & St. Paul are reported to be busier with work than they have been since 1893. There is a force of 2,400 men engaged in the various shops. They are building ten new box cars of 60,000 pounds capacity, and expect to keep this up for some time. Besides the new work, there is an unusual amount of heavy repairs to locomotives and cars being effected.

The Laconia Car Works, of Laconia, N. H., have been reorganized, and it is expected that they will begin building cars about the time this paper appears.

Kinks in Blacksmithing on the Louisville & Nashville Railroad.

The system of perpetuating a standard after it is once established, by means of the blueprint process, is fostered with great care by Mr. Pulaski Leeds, superintendent of motive power of the above railroad, and to a rigid insistence that no explanation will be accepted for a failure to work in accordance with the lines laid down, the success and continuance of the adopted order of things is due. The blacksmith shop comes in for full and equal consideration with the other branches of the machinery department—a fact that is worthy of more than passing note, for the reason that, in general, while

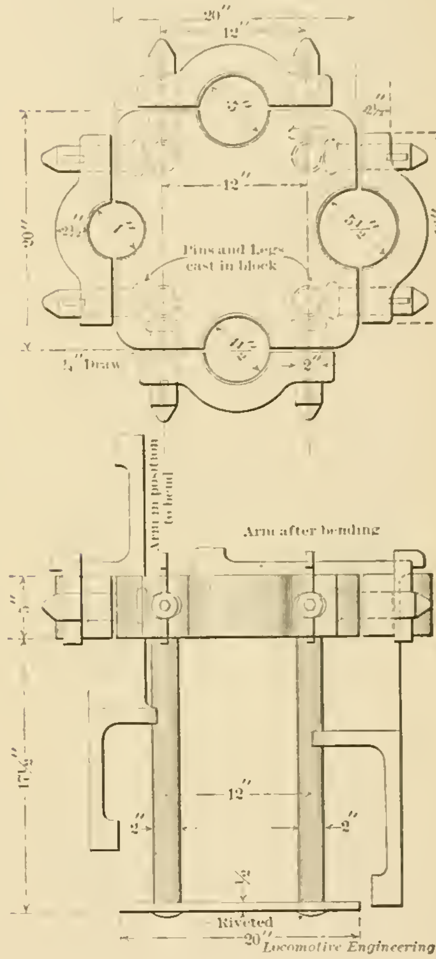


Fig. 1

KINKS IN BLACKSMITHING.

the smith is furnished with drawings to produce certain shapes, he is left to his own resources in the matter of how to accomplish the results required. It is the treatment of the job while under manipulation, that makes the difference between the botcher and the artist, and with the object in view of securing uniformity in the finished pieces, as well as in the process of their manufacture, the special methods shown herewith were devised.

It is a matter of common knowledge among the craft, that it is possible to forge a rocker shaft in more ways than one, some of which leave the finished product fair to look upon, but expensive enough when viewed in the light of welded-on arms, and their constant liability to part company with the parent body. This opening for improvement was taken advantage of by the bending block, Fig. 1, which is of cast iron 5 inches thick, supported on four 2-inch columns and a base plate ½ inch thick. The block is cast with four semi-circular depressions, one on each edge, which are of such dimensions as will cover the diameter of all sizes of rocker shafts. Fitted to each edge is a clamp held by two 2-inch key-bolts which are cast in the plate. The clamp forms the other half of the hole into which the rocker is securely held while the arms are bent at right angles to the body, as shown in the elevation. The forging is first drawn out to template, and afterwards bent to shape on the block, the advantages of which processes are plainly a reduction of time, a stronger job because the fibers are unbroken, and absolute uniformity in the output.

One of the most convenient accessories to the steam hammer is the swinging crane for supporting swedges, shown in Fig. 2, together with the swedge and its manner of application to the hammer. It is simply a bar of 2-inch round iron, with a collar at the lower end resting on a clamp which is bolted to the anvil casting of the hammer, and a like collar at the upper end, on which the swedge rests. The lower end may be clamped into a fixed position if desired, leaving the swedge free to revolve about the top for a center, and swung out of line with the work when not in use, as shown by the dotted lines. This little device saves the smith considerable hard work, and after seeing it in operation, it is difficut to conceive how swedges can be handled without it, especially in shops like these, where swedges are gotten up so thoroughly, and are so largely in use.

Handholds and ladder irons are put through three operations, as shown in Fig. 3. First, the iron is cut to length, with stock sufficient to upset a ball at each end, which operation is performed at the bolt-header. The next procedure is to make one bend at the anvil in a form giving the length of turn; the next and final move is to key the piece in a die, which is used for the last bend and also to form the balls into lugs for the bolts with which to secure them to the car. This die is seen to have a square projection on the lower side which fits into the hardy hole on the anvil, and is arranged to take two pieces at the same time. It is seen that all the work except the heading of the ends is done at the anvil, and that the power hammers have no part in its completion.

One of the best of the hand-operated devices for bending iron into shape is that shown in Fig. 4, used for forming the ½ x 1¾-inch bar into freight-car steps. It is a compact affair, consisting of a ⅞-inch plate which serves as a base to carry the dies, which are made up of two fixed pieces, and two pivoted handles. The material for the step is cut to length and the bolt holes punched, after which the straight bar is bent to shape around the die by closing on it the pivoted parts. While held in the die, the ends of the step are given a quarter twist by means of the fork shown; one heat suffices to complete the step from the straight bar. On a trial, under pressure for steps, 400 were completed in nine hours, with one smith, two helpers and one heater engaged.

Cast-iron dies for use at the steam hammer are made to fill a large void left by the lack of special forming tools known to the so-called modernly equipped smith shop. Fig. 5 represents one of these, in which chain hooks are bent on the diagonal of the square, and making a job that will compare favorably in point of finish and cost with any other method yet devised for that class of work. The lower die is fixed, and the upper one is portable, so as to be held over the work while the hammer is forcing the bar into the form of a hook, as shown bent. Dies of this type have an endless application in these shops, being made to cover a greater range of work than is thought possible in the average shop.

Car-door hasps are a simple little appliance in the economy of a freight car, but it will hold the best efforts of the hand artisan up to ridicule when an attempt is made to cope with the output of the dies shown in Fig. 6. These dies form and punch the hasp with two blows of the steam hammer at one heat. Constructed as they are with a hinge joint, there can be no errors made in placing the upper die on the lower; the two must always accurately register, and this is a point of no small importance when punching for the staple. The product of these dies are shown by the finished hasp.

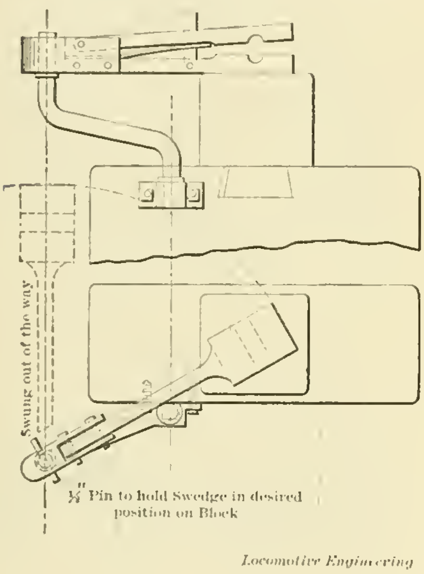


Fig. 2

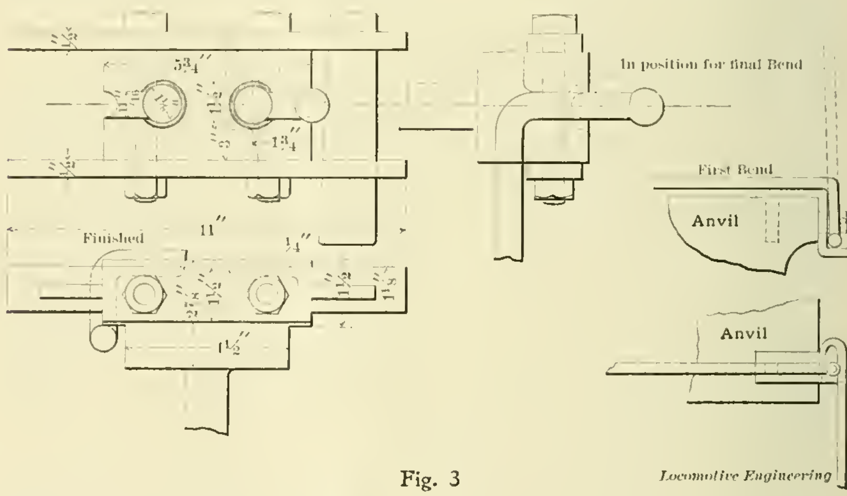


Fig. 3

KINKS IN BLACKSMITHING.

The hinged die shown in Fig. 7 is used in the preliminary steps of forming the heads of crown bolts. These bolts are drawn out of 1⅝-inch iron, in order not to upset and disturb the metal in the heads; this leaves the bolt ready for the dies in Fig. 8, which are used to finish the head and the short fit under the same. The head, it will be seen, is made by the upper die, and the fit by the lower one. These good examples of machined dies for steam-hammer work, nicely show by the finished head what is required and how it is done. The waste of material by this method of forming the heads of crown bolts, is reduced to nothing. The stock is cut for a given length of bolt, and when the head is formed and the body drawn to the proper diameter, the bolt is finished to the correct length, without any cutting off and consequent sacrifice of metal.

Fig. 9 is a pair of dies for stamping a piece of 1¼-inch iron into a disk with a depressed hexagonal center, used for water-pipe plugs. Without the dies, it would be necessary to cast these pieces in order to obtain them at a reasonable cost. The dies make it possible to produce these pieces out of scrap material at a cost favorable to the wrought iron. The side of the lower die has a hole tapped 1 inch diameter for a handle to be screwed in at one side.

In Fig. 10 is seen a pair of dies for making wrenches. The size shown is for a ⅞-inch wrench, and it is endowed with a great degree of elasticity in covering several sizes besides its nominal one, for the reason that after a wrench is formed, it may be opened for a larger nut, or closed for a smaller, within reasonable limits, without impairing its lines to any appreciable extent. The ends only are formed in the die, after which any desired length of handle is welded on. The bottom die is made of two pieces which are bolted together, the upper part serving as a guide for the die struck by the hammer. A 1-inch rod is also tapped into the lower die, for a handle to manipulate by under the hammer.

A die similar to the above is that for punching the gib slots in spring hangers, as shown in Fig. 11. This die is built in the same general way as Fig. 10, except in the matter of the forming faces and in having the handle forged on. This die also represents a type used for punching equalizer posts, pilot push-bars and other heavy work requiring rough slotting.

Something on the same order as above, but for a different class of work, is the die shown in Fig. 12, used for punching the pinholes in the swing hangers of passenger-car trucks. Like the others, this die has a guide plate, bolted to the upper face, the plate also acting as a stripper on removing the punch. The steam hammer puts the punch through, leaving a clean and smooth true hole.

Fig. 13 is a die for bending carry irons for drawheads. The engraving shows that the lower die is to be keyed to the hammer anvil, and with the block in place on the ¾ x 4-inch iron, the imagination is not taxed in its understanding of what will occur when the hammer comes down.

Middle connection pins for side rods are formed in steam-hammer dies as shown in Fig. 14. The pin is left with ⅜-inch stock all around, and with an end on for the lathe dog to secure a driving hold while the circular work is under way. This is a sample of the style of former extensively used on unsymmetrical round shapes, and represents the best practice in hammer dies, standard in this shop for everything where dies can be used.

The outside long leaf of driving springs is reinforced at the ends for the hanger gibs, by turning the metal over on itself and welding, after which they are formed in the dies shown in Fig. 15. Truck springs are put through the same process by the dies, the only difference being in the shape of the contour of the enlarged end. The die is simply a 2 x 6-inch piece with a depression corresponding to the required shape, and an extension for a handle. The flat face of the hammer furnishes the other half of the die.

A combination die block for the steam hammer is shown in Fig. 16. It is devised and used for punching holes in follower plates, and firebox plugs, and also to form fillets on valve stems. The block is arranged with a guide plate similar to the other punching dies noted, but has in addition a recess to receive the dies, under which is a cored passage for the escape of the punched blank. A stock of dies for a wide range of holes goes with this block and makes it one of the valued adjuncts of the steam hammer.

Punching, it will be noted, is here as fully important an accessory of the hammer dies as those for forming or bending. The die for punching keyways in drawbar stems, shown in Fig. 17, is another example of a good arrangement for the steam hammer. It consists of a die block fitted to the hammer anvil, and cored at its top to receive two die clamps which are keyed fast in position on the block. These clamps have a hole horizontally to take the drawbar stems, and are also slotted vertically ⅝ x 2¼ inches for the punch; the walls of the vertical slot are 1½ inches deep, and afford a good bearing as a guide to hold the punch in line with the center of the round section of the stem.

A punch and die for keyways and cotter-pin holes for bolts and pins are shown in Fig. 18. This rig was devised for use in the bolt-heading machine, where it has proven highly successful. The punch is fitted to the ram of the machine, and the dies are held in the side-heads. The dies are made to take in several sizes of

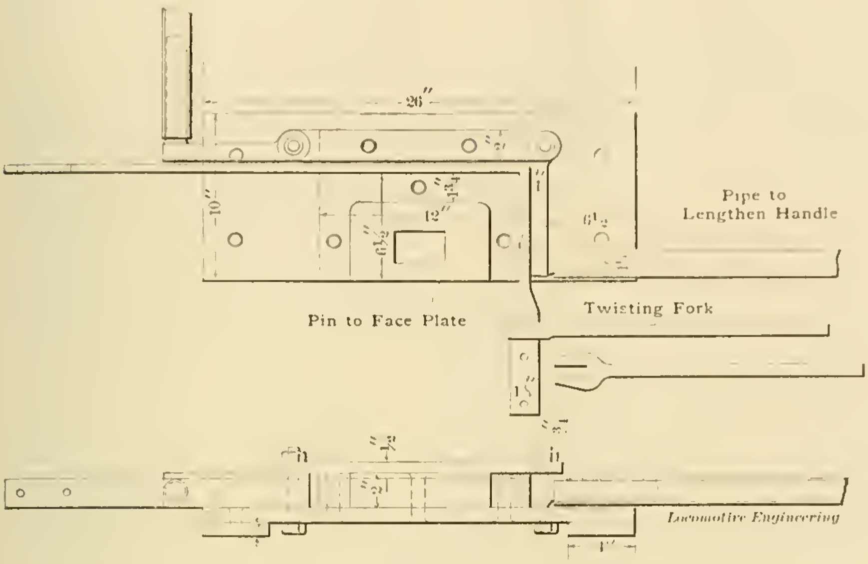


Fig. 4

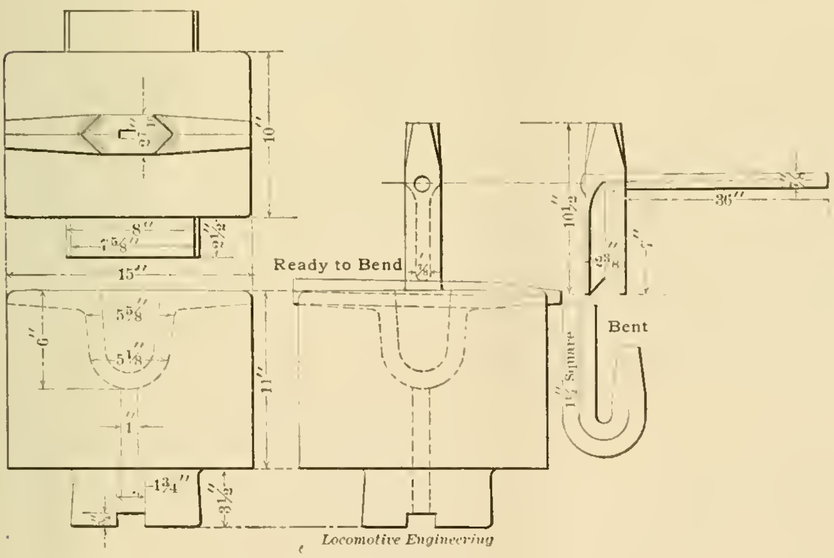


Fig. 5

KINKS IN BLACKSMITHING.

bolts, and are used with the cotter or key punch at pleasure by reversing their position in the machine. This punch has a record of 1,900 cotter holes in brake-lever pins in ten hours. It is not a question of how many can be punched, but rather how many can be heated—the furnace is the controlling factor. For keys, a ⅛ x ⅝-inch steel punch is used with the dies shown.

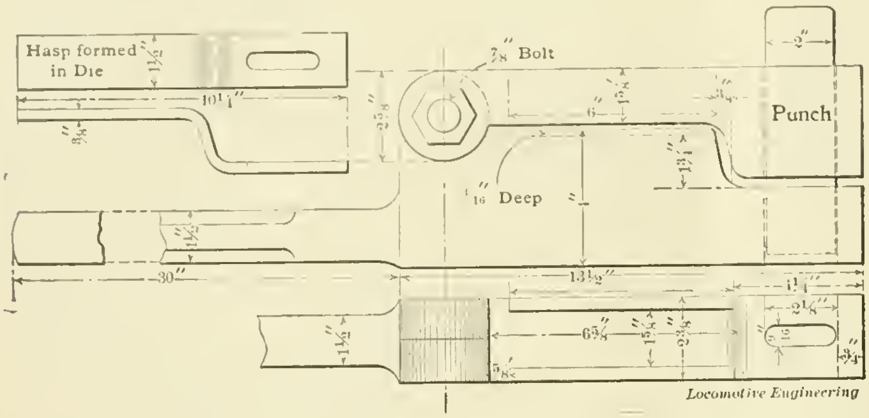


Fig. 6

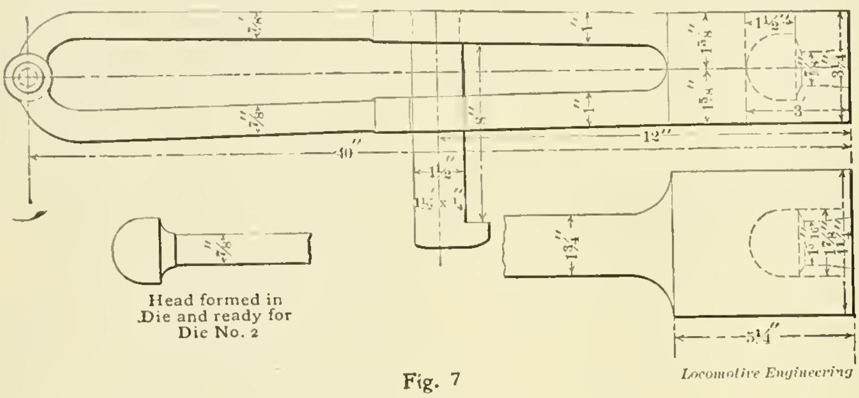


Fig. 7

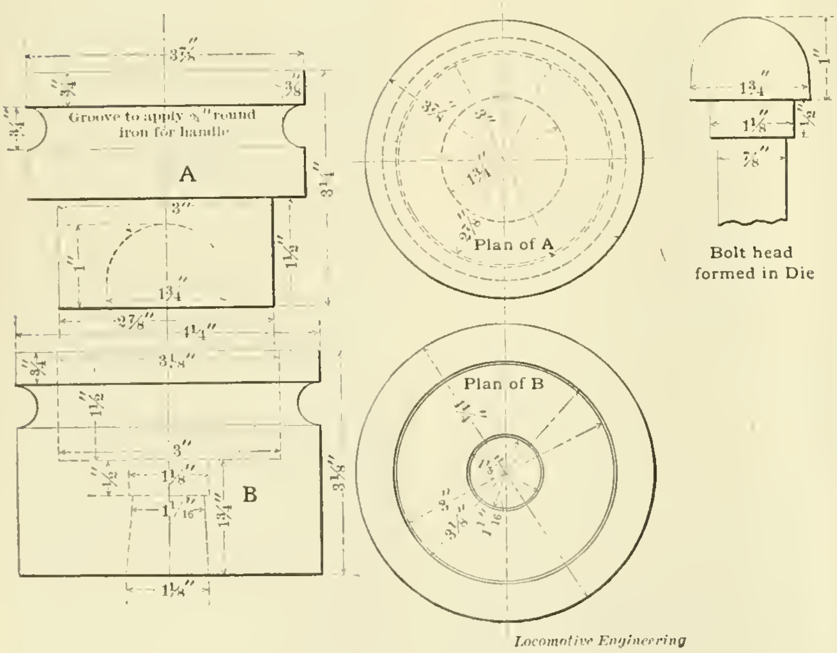


Fig. 8

KINKS IN BLACKSMITHING.

The former shown in Fig. 19 is one of the portable handy tools that always make handsome returns on the investment. It is used on front-end braces, equalizer posts and valve yokes, by being cored the proper size to receive those parts. Two holes of different dimensions, suitable to take in a front-end brace, pass through the casting, which is supported on four 2-inch columns to which the top and base are riveted. The holes for the braces are cast in at the correct angle with the top face of the former, and their function is to hold the body of the brace so that when the foot of same is brought to the face of the former, the two parts will bear a correct relation to each other, or, in other words, the foot will be at the desired angle with the body.

Valve stems are squared up with the yoke, in the hole shown at the left, and the hole at the right performs a like office in making the post square with its base. All these jobs require the exercise of skill, where no provision is made to help out aside from the anvil and hammer, and this tool has been devised to reduce the long waits attending the necessary trying and fitting by hand, which operations are

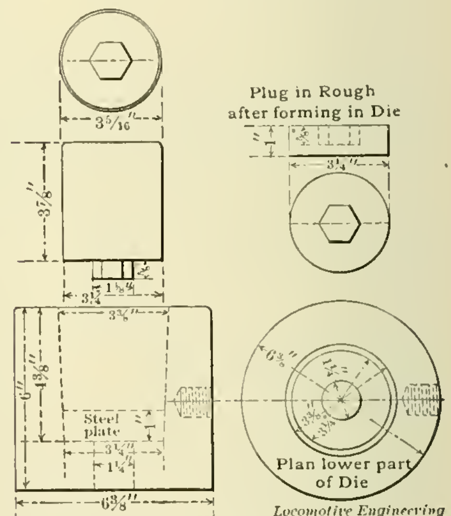


Fig. 9

KINKS IN BLACKSMITHING.

reduced to the minimum by reason of accuracy when the job leaves the former.

Enough examples of the formers and dies have been furnished to give a clear idea of the practice in this respect, but they cover only a very small part of the number actually used. It is well within the truth to say that quite all forging is done by dies, to the exclusion of all other methods, and the exhibit of tools for the purpose is a creditable one; indeed, it is second to none. Mr. John Donahue, the foreman blacksmith, is an ardent advocate of die-work, and is constantly engaged in devising something new in that line.

The Boston & Maine people are equipping their passenger cars with air signals as rapidly as possible. Hitherto they have used the antiquated bell cord.

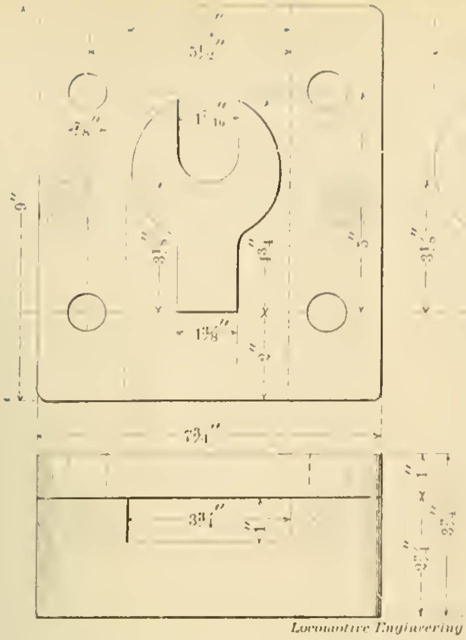


Fig. 10

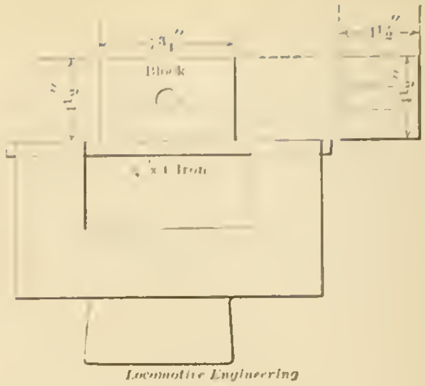


Fig. 13

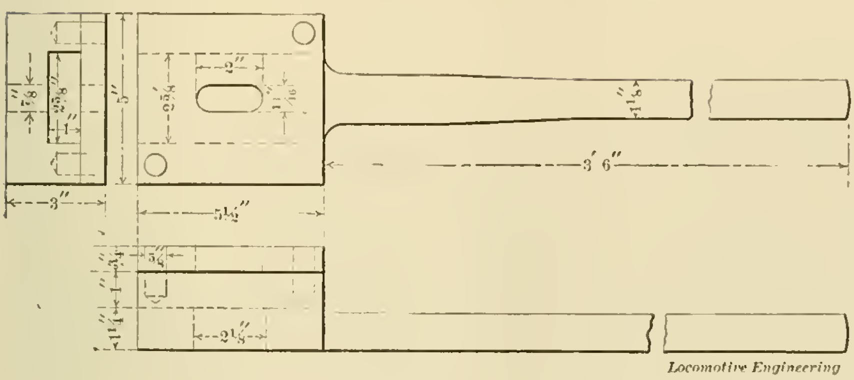


Fig. 11

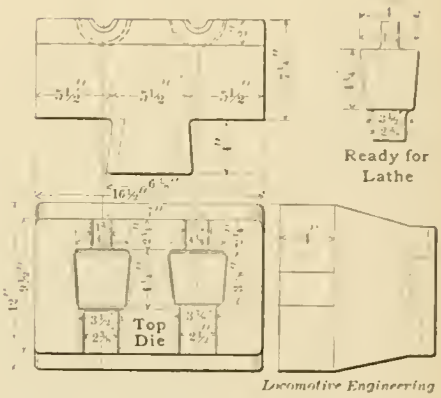


Fig. 14

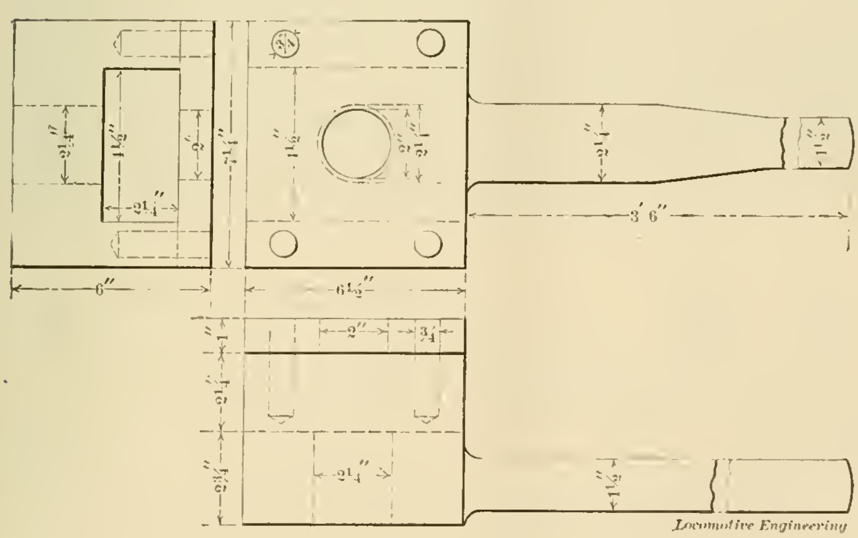


Fig. 12

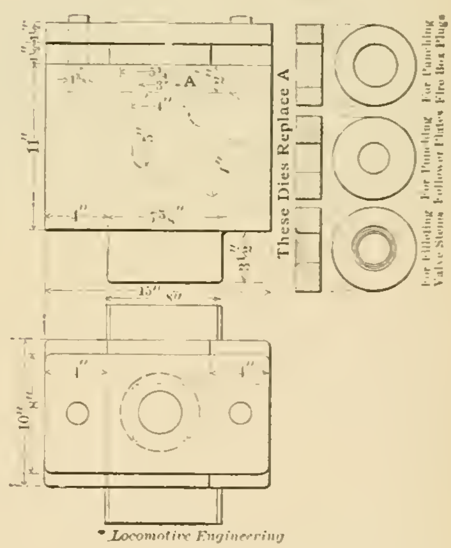


Fig. 16

KINKS IN BLACKSMITHING.

If you want to hear a good, jolly story, says the "Texas Railway News," just get in a crowd of Texas railway conductors and you will hear a series of them. At first you will place very little credence in what they relate, but after listening a while you will begin to believe that the half had never been told. They have such an earnest, interesting way of relating their anecdotes. But when it comes to a thrilling hair-breadth escape story, just listen to a Texas engineer. It is universally conceded that they can make more hairs stand on end in relating their escapades than a conductor can. Both classes of railway men are interesting entertainers.

The Atchison, Topeka & Santa Fé are putting up a new building at Topeka, Kan., to be used as an upholstering establishment.

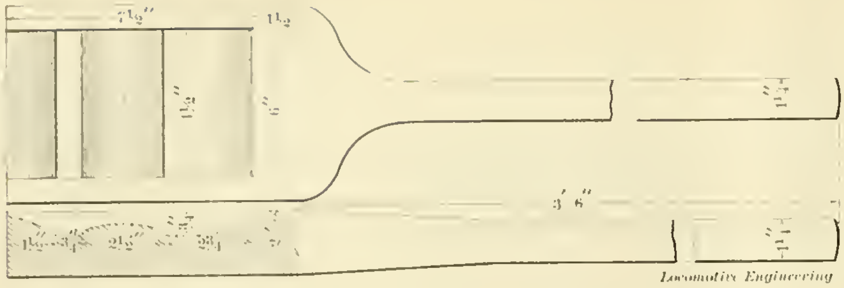


Fig. 15

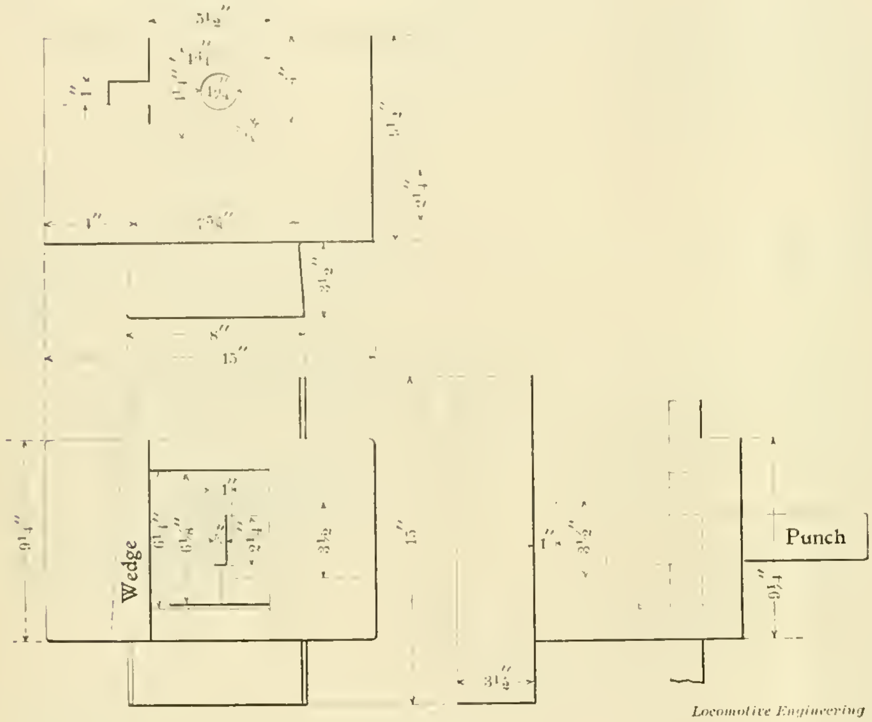


Fig. 17

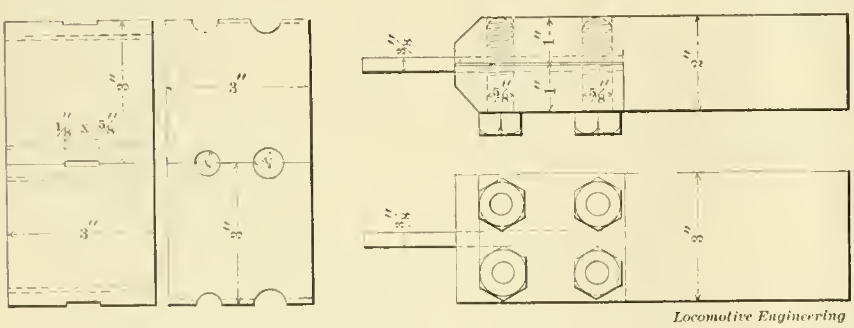


Fig. 18

KINKS IN BLACKSMITHING.

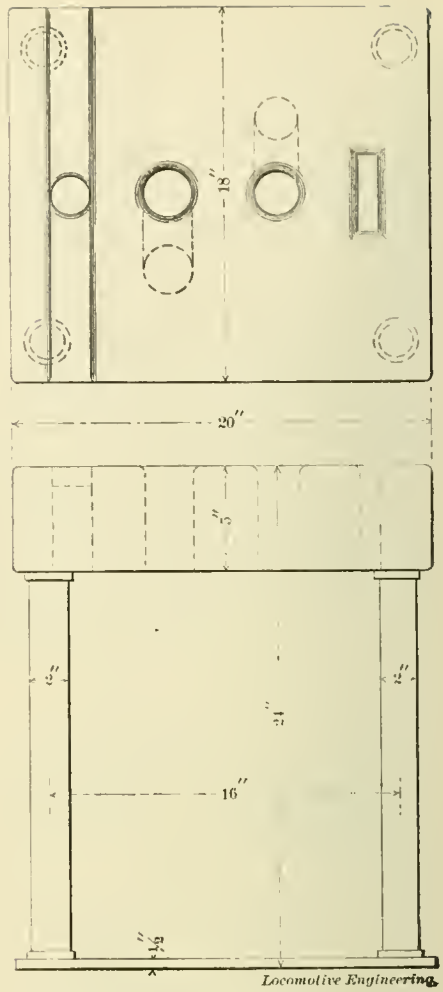


Fig. 19

The Cleveland Cincinnati, Chicago & St. Louis R. R. have ordered from the Richmond Locomotive Works a heavy consolidation locomotive. It will most likely be adopted as a standard of the company, that finds the need and economy of heavy machinery. They also ordered three sets of cylinders to convert that many of their simple engines to the Richmond Compound fuel saver, of which they have a number already in service.

The Clayton Air Compressor Works, Brooklyn, N. Y., offices, Havemeyer Building, 26 Cortlandt street, New York, report that their volume of sales for the month of October is larger than any preceding month in the history of the business and three times greater than their average sales for five years past. These works are now constructing one twenty-five horse power compressor for 3,500 pounds pressure, and one fifty horse power compressor for 2,500 pounds pressure, for the Western Manufacturing & Oil Company, Newark, N. J. They also have orders in hand for a compound air compressor ordered by Fraser & Chalmers, of Chicago; a duplex air compressor for the Deane Steam Pump Co., Holyoke, Mass.; three duplex air compressors for compressed air shop plants, two air compressors for the Consolidated Pneumatic Tool Company, one air compressor for sand blast work, one for operating pneumatic railway signals, two compressors for air lift pumping plants, two compressors to the Shone Company, of Chicago, for their pneumatic sewerage system, and one large duplex compressor for the Consolidated Gas Company, New York.

The eighth part of "Easy Lessons in Mechanical Drawing and Machine Design," by J. G. A. Meyer, is fully up to expectations, and gives further evidence of the care of the author. In addition to the drawings, there are "Practical Rules and Useful Data," which are invaluable to any thinking mechanic. These include mensuration, or measurement of surfaces and solids. A chapter on "Practical Machine Design," with a plate showing the finished design, is also very interesting. These are published by the Arnold Publishing House, 16 Thomas street, New York.

Brooks Consolidation Engine for the Mexican Central Railway.

Our half-tone of the consolidation engine for the Mexican Central Railway Company, Limited, is a sample of an order for ten of the above type just completed by the Brooks Locomotive Works. These engines come in the category of the heavy ones, but while the total weight falls slightly below that of some of the recent freight monsters, their boilers are of Brobdignagian proportions, such that convey an air of immensity greater, perhaps, than would a comparison of weights alone. The boiler, of the Player improved Belpaire wagon-top type, is 74 inches in diameter outside at the small ring, 81⅛ inches at the throat, with 374 2-inch flues, and has a horizontal grate above frames. The motion of the eccentrics is transmitted from the link to the rocker by means of a bar passing from the rocker forward to the link block, and continuing to a hanger suspended ahead of the link; this allows of a fairly good length of straight eccentric rod. The spring rigging is hung with the springs over the front and second wheels, with the familiar saddles on top of boxes, but the third and rear wheels have equalizers on tops of the boxes, and the springs occupy places between upper and lower frame sections; or, in other words, the position of springs and equalizers are transposed from the second wheels back, and is no doubt a safer arrangement than any underhung scheme yet devised, although perhaps not as convenient as the latter in case of break-down. Dimensions of the engine and general particulars are given below:

Type—Consolidation.

Fuel—Bituminous coal or wood.

Weight in working order 180,000 pounds.

Cylinder, size—21 x 26 inches.

Slide valves—B. L. W., balanced

Driving wheels, diameter—57 inches.

Driving wheel centers—Cast steel.

Engine truck wheels—28 inches, with Krupp crucible steel tires.

Boiler—Player improved Belpaire.

Boiler, material—Steel.

Boiler pressure—180 pounds.

Boiler covering—Johns fire felt.

Firebox, type—Above frame.

Firebox material—Firebox steel.

Firebox, length inside—120 inches.

Firebox, width inside—37¾ inches.

Tubes—Number, 374; diameter, 2 inches; length, 11 feet 1 5-16 inches; No. 12, B. W. G.

Heating surface tubes—2,146 square feet.

Heating surface firebox—204 square feet.

Total heating surface—2,344 square feet.

Grate surface—31.5 square feet.

Tender wheels, number—Eight.

Tender wheels—Krupp crucible steel, 33 inches diameter.

Tender frame—9-inch channel steel.

Water capacity—4,500 gallons; coal, 9 tons.

Metallic packing—R. R. company's style.

Bearings—Brass.

Brakes—Westinghouse, American.

Brake beams—Player.

Le Chatelier water brake.

Train signal—Westinghouse.

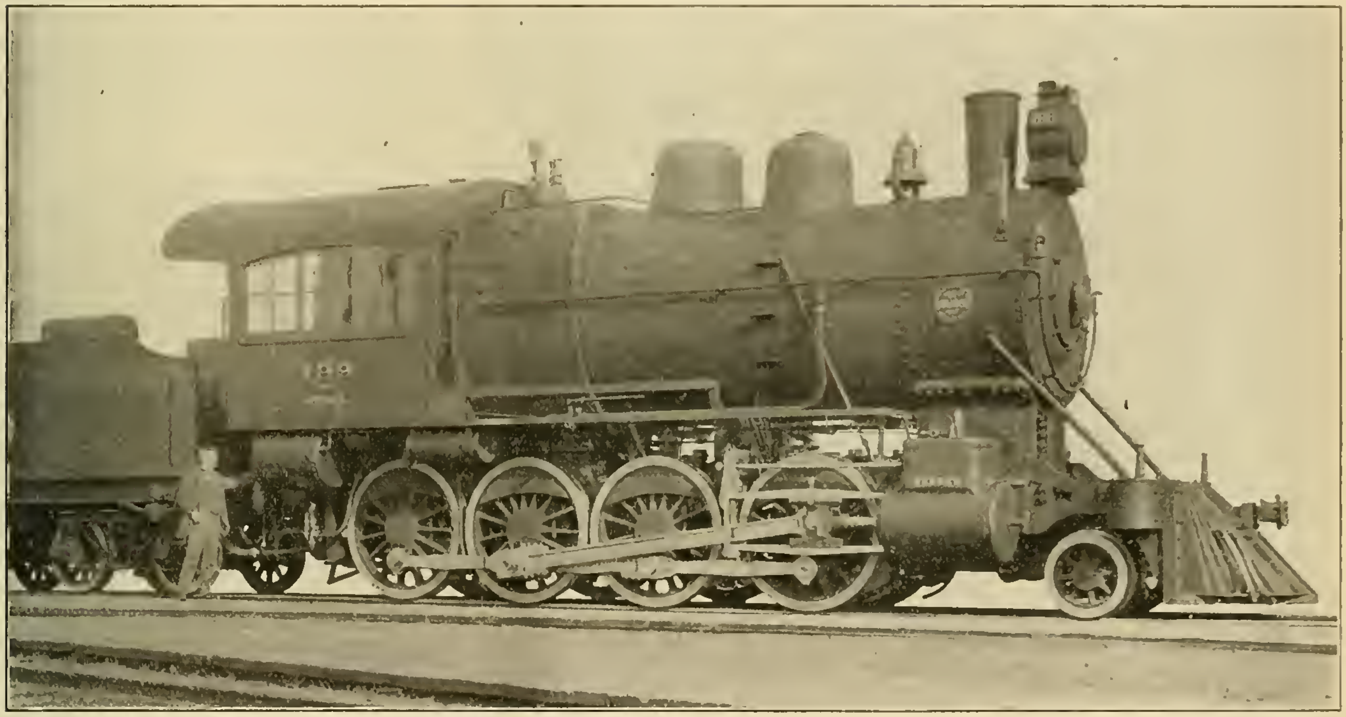
Safety valves—Three 3-inch Crosby.

Lubricators—No. 9 Nathan, oval.

Injectors—One No 9 and one No. 10 Friedmann.

Gages—Crosby, whistle, one 6 inch Barnes; springs, Scott; headlight, one 18-inch, circular case.

Axles, piston rods and staybolts of Taylor iron. Crank pins of hammered steel Driving boxes, cylinder heads, steam chests and covers of cast steel. Steam chest casings and smoke-box front and door of pressed steel.



BROOKS CONSOLIDATION FOR MEXICAN CENTRAL.

So far as our tastes are concerned, we consider the Annual Report of the Traveling Engineers is the most interesting report that comes to this office. We have just received the report of the convention held at Chicago in October last, and it makes the kind of reading that one would expect from listening to the reading of the reports and the discussions thereon Every page of the report seems to be full of practical information, and so much might be said about the various reports that we consider selecting one or two for commendation would be ungracious to the others. The best advice that we can give to those who see this item is to send to this office and secure a copy. Price, 75 cents for paper bound, and $1.00 for leather bound.

The Pennsylvania Railroad Company, like many others, are suffering from a freight-car famine. Instead of giving panic orders for the construction of new cars, the company's officers are devoting all their energies to getting greater mileage out of the cars they have in service. They think that by thus managing, they can terminate the car famine without extra expense to the company.

The Safety Appliance Situation.

The Inter-State Commerce Commission makes public the facts that out of 436 railroads that have reported to the commission in the matter of safety appliances, 75 or 17.20 per cent., will be equipped with automatic couplers by January 1, 1898; of 435 roads, 60 of them, or 14 per cent., will be equipped with train brakes by January 1, 1898, and out of 517 roads, 96 per cent. will have power driving-wheel brakes on locomotives by the same date.

It is also reported that protests have been filed against allowing the roads an extension of time for completing the equipment of rolling stock with safety appliances. What action will be taken in this regard will not be known, however, until the applications for an extension of time are heard by the commission.

New Pipe-Cutting Machines.

The machine shown with this is the latest development of the firm of D. Saunders' Sons, Yonkers, N. Y., in the pipe-cutting line, for sizes from ¼ inch to 2 inches, inclusive, which are the ones most used in railroad shops. Larger sizes are also made.

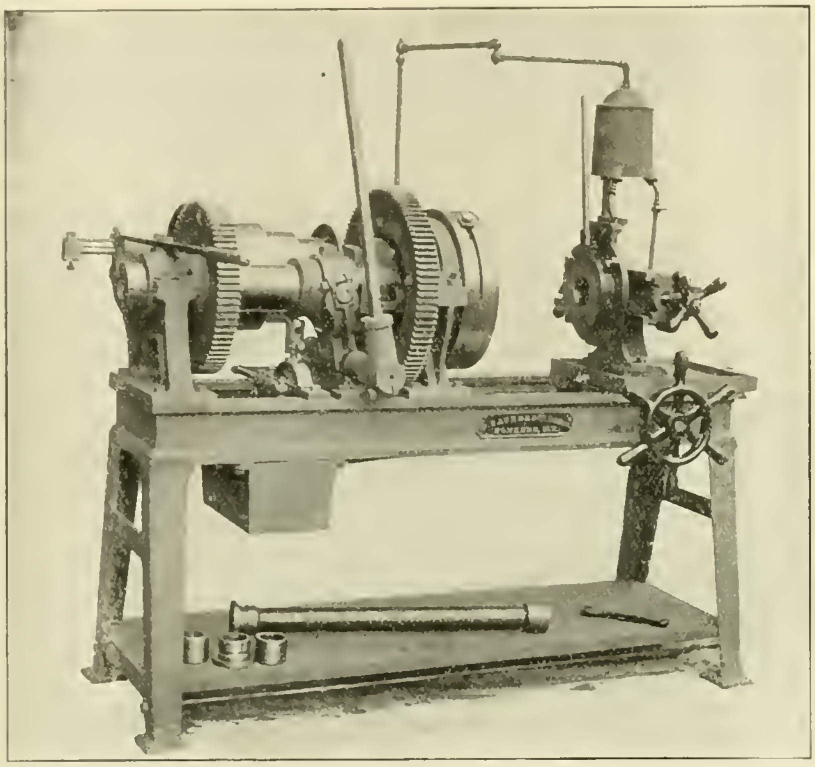
The machine is back-geared, as will be seen, and has eight changes of speed.

The pipe to be cut is passed through the hollow spindle and gripped by the chuck, which has been set to the proper size. The chuck is controlled by the lever shown.

The large hand-wheel moves the carriage. The die head is moved out of the way when cutting off; but there is a stop-pin which allows it to be moved to a central position very readily and with certainty.

The dies are opened and closed by the vertical lever, the size being controlled by an adjustable stop. For the small sizes handled by this machine, it has been found better to have complete die heads for each size.

Cutting-off tools, front and rear, are controlled by the small hand-wheel shown in front of rest. This is also very efficient in cutting off round bar iron up to 2 inches in diameter.



SAUNDERS' NEW PIPE THREADING AND CUTTING MACHINE.

An oil pump continually floods the dies, and a large oil tank is provided.

It is reported that the Rhode Island Locomotive Works will be sold at public auction on December 23d, to satisfy a mortgage of $300,000. We understand that certain monied interests in Providence are making efforts to obtain possession of the works, with the view of starting them up again. There ought to be a place for a good locomotive building plant in New England, and the neighborhood of Providence would probably be as satisfactory as any; but the site where the Rhode Island Locomotive Works are now located entails so much extra expense for transportation, that to try and run modern works at such a place would be inviting failure. If the works were placed at tide-water, where supplies could be received at the lowest possible cost, enough money would be saved of the expense incurred in hauling material to and from the present site of the locomotive works, to pay a good dividend in itself.

The Western Railway Equipment Company, of St. Louis, report having sold 180 of their Houston track sanders, during the month of October, to the following roads: The Western Maryland, for two shops; Baltimore & Ohio, for two shops; New York, Ontario & Western, for two shops; Main Central; Texas & Pacific; St. Louis Southwestern; Denver & Rio Grande; St. Joe & Grand Island; St. Louis, Chicago & St. Paul; Missouri Pacific; Sea Board Air Line; Baltimore & Ohio Southwestern; Pittsburg, Lisbon & Western; the Erie; Kansas City, Fort Scott & Memphis; Missouri, Kansas & Texas; St. Louis, Iron Mountain & Southern; Kansas City, Memphis & Birmingham; International & Great Northern; Atchison, Topeka & Santa Fé; Schenectady Locomotive Works; Baltimore Locomotive Works; Pittsburg Locomotive Works; Dickson Manufacturing Company.

The big ten-wheel express engines recently purchased from the Baldwin Locomotive Works by the Southern Railway, and illustrated in the June number of "Locomotive Engineering," are at work on a Southern division, and are reported to be giving great satisfaction. An agent of the Associated Press, telegraphing about the performance of the engines, says that they can haul as much as four of the average passenger locomotives used in this country. One of them could pull, at the rate of 60 miles an hour, on a level track, no less than thirty-three Pullman cars, weighing 40 tons each. He is kind enough to quote part of the description of the engine that appeared in "Locomotive Engineering," but, of course, omits to mention where he found the information.

One of our correspondents on the Cincinnati, Hamilton & Dayton writes us, that under the direction of Mr. F. O. Miller, traveling engineer, there has been quite an effort among the engineers and firemen to overcome the smoke nuisance. They have done remarkably well, showing that an intelligent fireman is the cheapest smoke-preventative in the market.

During a recent visit to the Porter Locomotive Works, in Pittsburg, the writer paused before a Jones & Lamson lathe to watch the work. Noticing the interest we took in the tool, the superintendent remarked: "Fine lathe that. When we bought it the makers guaranteed it to do the work of three common lathes, and it has done the work of five."

WHAT YOU WANT TO KNOW.

Questions and Answers.

Correspondents wishing to have questions answered in these columns should send in their names and addresses, not for publication, but for evidence of good faith. We throw all anonymous letters into the waste basket.

(87) G. H. F., Concord, Mass., asks:

Which wheel of a car truck travels farthest when going through a curve, the one on the outside or the one on the inside of the curve? A.—A pair of car wheels pressed on an axle must necessarily make an equal number of revolutions in traversing a given distance; there can be no difference, since the wheels cannot revolve independently; but while the revolutions remain the same, the difference in the length of the rails on the curve is overcome by sliding of the wheels.

(88) C. E. N., Mandan, N. D., asks:

What makes an engine ride hard when the main centers of the axles tram, say, 1-32 or 1-16 inch longer on one side than on the other, the rods being of the right length? A.—The hard riding may be accounted for under the conditions by the binding of rods on the pins—provided rods could be coupled up with the assumed status of axle centers; something, we have an opinion, that would be difficult to do with rods of correct length, with the usual allowance for expansion, even if the brasses were bored fuller to the pin than usual. If rods were forced to place, the binding on the pins would be quite enough to make an engine ride hard—and hot.

(89) W. L. C., Meriden, Conn., asks:

What is the reason that the wheel flange on a railroad car runs on the inside of the rail, whereas the wheel flange of an "Industrial" railway car, used about the yards of industrial works, have the flanges outside of the rail? A.—The location of wheel flanges on the inside of rail was no doubt due to the greater safety of that position, since rail shocks tend to hold the wheel to position in case of a loose axle. A reference to the catalog of the builders of the narrow-gage cars having wheels with flanges on the outside, makes plain the reason for their location, namely, in rounding the very sharp curves they are used on—12-foot radius—the flange mounts the outer rail, and the pair of wheels thus become sections of a cone whose apex approaches the center of the curve—an ideal condition for least curving resistance.

(90) H. G. S., Mechanicsville, N. Y., writes:

Will you please state when, if at any time, it is possible that there can be more than boiler pressure in the cylinders of a locomotive having Richardson balanced valves and running with an open throttle? A.—It is not an unusual thing to compress steam in the cylinders to a point above boiler pressure. This will occur when cutting off short, if an engine has excessive mid-gear lead or inside lap, or both, for the reason that when an engine is given lead, all events in the operation of the valve take place earlier than when without it; that is, admission, cut-off, exhaust opening and exhaust closure are hastened with reference to the piston travel. Heavy compression due to closing of exhaust early in the stroke, supplemented by too much lead, furnish the resistances that produce a pressure in the cylinders higher than that in the boiler.

(91) L. S. H., Brooklyn, N. Y., writes:

Will you please answer the following questions? 1. What is absolute pressure? A.—It is pressure measured from the zero line of pressures, or vacuum, and is found by adding atmospheric pressure to a known pressure above atmosphere; as, for example, a boiler pressure of 100 pounds, as indicated by gage, would be 100 $+ 14.7 = 114.7$ pounds absolute pressure at sea level. 2. What is the ratio of expansion? A.—It is the relation of volume at the end of stroke to volume at point of cut-off; to find the ratio of expansion divide the length of stroke in inches by the number of inches at which steam is cut off. Example: An engine with a piston's stroke of 24 inches cutting off at 6 inches, has four expansions, and the ratio is therefore four. 3. What is effective pressure? A.—It is the difference between the moving pressure on one side of a piston and the back pressure on the opposite side. 4. How can I find the mean effective pressure from the absolute pressure? A.—Let P = initial absolute pressure of 114.7 pounds, as taken above; R = ratio of expansion 4, and P' = mean effective pressure, then

$$P' = \left(\frac{1 + \text{hyperbolic logarithm } R}{R} \times P\right) -$$

atmospheric pressure. Finding the logarithm of the ratio of expansion in a table of hyperbolic logarithms, and placing the values in the formula, we have:

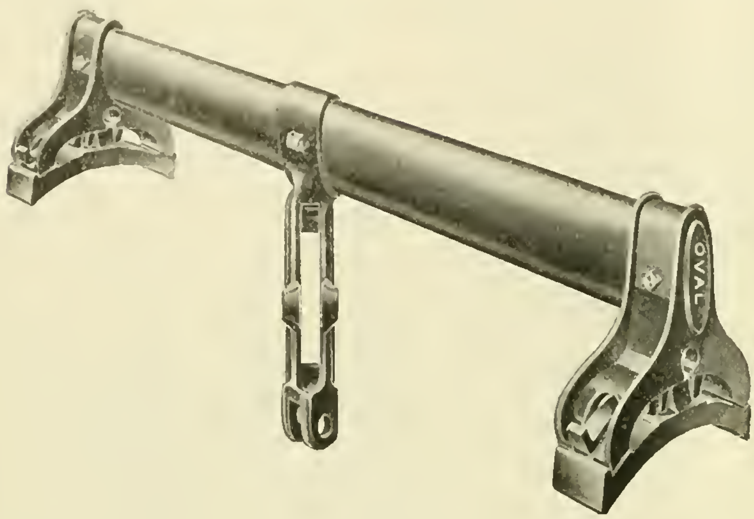
$$P' = \left(\frac{1 + 1.3863}{4} \times 114.7\right) - 14.7 = 54.41$$

pounds mean effective pressure. 5. What is meant by initial pressure? A.—It is the pressure of steam when admitted to a cylinder. 6. Do I change the lead by shortening or lengthening the eccentric rods? If not, why not? A.—Any change of lead by the method proposed will destroy the equalization of same, by increasing the lead opening at one steam port and correspondingly decreasing it at the other. This result is due to the distortion of the valve travel over the center line of the valve seat. 7. How can I find the horse-power of an engine by the use of an indicator? A.—Find the foot-pounds of work done in one minute and divide by 33,000. Expressed in writing, the proposition reads: (Area of cylinder × mean effective pressure as found by the indicator × twice the stroke in feet × revolutions per minute) ÷ 33,000. This is horse-power developed in one cylinder; for both cylinders, multiply by 2 if the indicator readings are alike for both sides of a locomotive. 8. What is the weakest part of a boiler? A.—There is no weakest part if a boiler is properly designed and constructed. 9. How and where is a boiler braced? A.—Practice in boiler bracing is different with different builders; they are sometimes braced longitudinally, with rods extending through from the back head to the front flue sheet; rods are often used running diagonally from the front and back heads to the upper part of the boiler shell. Many builders vary this practice by using gusset stays instead of the diagonally placed rods, or in combination with them. In crown-bar boilers sling stays are in general use between the crown bars and top of boiler shell. 10. How can I find the horse-power of a boiler? A.—The American Society of Mechanical Engineers have adopted, for a commercial horse-power, the evaporation of 34½ pounds of water per hour, from a feed-water temperature of 212 degrees Fahr. into steam at the same temperature. See our October, 1896, issue, where boiler horse-power is fully treated. 11. What causes a blister on a side or crown sheet? A.—The late Alex. L. Holley has written on this subject, as follows: "The comparative want of homogeneity in iron is both an indirect and a direct cause of its ultimate failure. It facilitates the formation of blisters in the manufacture of the plate, and it offers less resistance than copper to the trying effects of fire. Blistering is due chiefly to the imperfect welding of the component parts of the pile of blooms composing the plate." We will take occasion here to mention, for the benefit of our correspondent, that we have, in our book department, works covering all phases of steam engineering in a more complete form than can be expected in such brief space as we are obliged to give to questions in these columns, and we urge a study of them to those who seek advancement in those lines.

Americans, as a rule, are grossly careless about putting sufficient postage on letters that go abroad, and railroad companies are the worst offenders in this respect. A firm in London that has a great deal of correspondence with railway companies on this side, informs us that about 30 per cent. of the letters received from our railway offices have only the domestic 2-cent stamp upon them. This shows a scandalous condition of carelessness in our railroad offices. We notice, ourselves, that letters coming from some railroad companies never have more than one 2-cent stamp upon them, although they weigh three or four times the weight that the stamp pays for.

The Oval Brake Beam.

The brake beam hereby illustrated will strike railroad men favorably, owing to its simplicity of form and the few attachments it has. The beam has been thoroughly tested for strength, and has displayed extraordinary rigidity. Another



OVAL BRAKE BEAM.

remarkably good feature about the beam is that, when suspended from a car or truck, it is evenly balanced, no chains or hooks being required to keep the brake shoes in their proper position.

An examination of the illustration will be sufficient to convince practical railroad men that a new beam of unusual merit is ready for adoption. It has been put on the market by the Oval Brake Beam Company, Philadelphia, Pa.

We have a section of this brake beam in the office of "Locomotive Engineering," and are always glad to show it to visitors.

While reports are coming in from every section of the country, intimating that, in spite of the shortening of daylight, shops have been put upon longer time, an exception is found in the case of the Grand Trunk of Canada. The shops at Stratford and London have been put to work 45 hours a week.

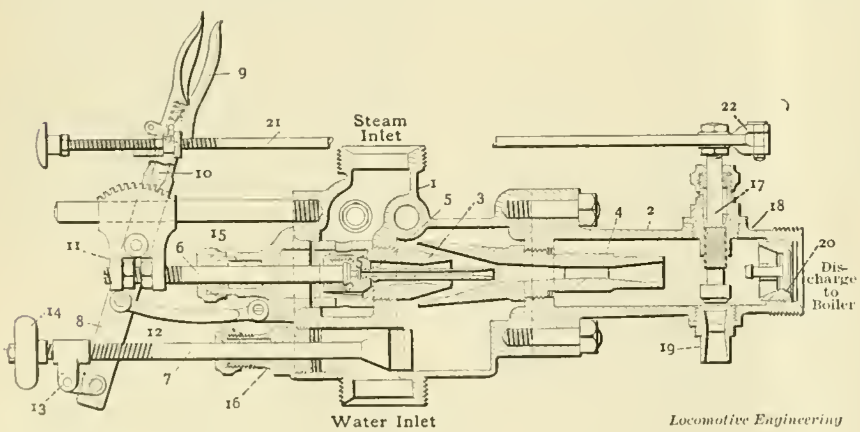
The "Dodge" Injector.

This is the latest type of injector, which was formerly made by the National Tube Works, and patented by W. E. Dodge, who was their superintendent for twenty-seven years. This is now controlled by the Fitchburg Steam Engine Co., of Fitchburg, Mass., who are now pushing it largely in railroad work.

As will be seen, this is practically a "single movement" injector, the same lever controlling both the lifting and forcing jets. It is claimed that its special design enables it to deliver water to boiler hotter (with same use of steam) than any other injector, and that it saves fuel in consequence.

It is interchangeable with any other standard make, and its ports can be removed for cleaning or renewal, without disconnecting the injector from the pipes. The range of both the water delivered and the steam pressure with which the injector can be worked is said to be equal or greater than any other. The illustration will make its workings clear to the engineers and mechanics.

If you are interested in railroad or engineering literature, send for our list of books.



DODGE INJECTOR.

EQUIPMENT NOTES.

(Continued from page 904.)

ordered four more six-wheel connected engines of the Baldwin Locomotive Works.

Two six-wheel connected engines are being built for the Southeastern & Atlantic Railway by the Baldwin Locomotive Works.

One consolidation engine is under construction at the Baldwin Locomotive Works for the Choctaw & Oklahoma Railway.

The Baldwin Locomotive Works are building ten six-wheel connected engines for the Omaha, Kansas City & Eastern Railway.

The Baldwin Locomotive Works are engaged on an order for six-wheel connected engines for the Western Maryland Railway.

The Pittsburgh, Bessemer & Lake Erie Railroad are having four ten-wheel engines constructed at the Baldwin Locomotive Works.

The Oregon Railway and Navigation Company are having five six-wheel connected engines built at the Cooke Locomotive Works.

The Richmond, Fredericksburg & Potomac Railway are having two six-wheel connected engines built at the Richmond Locomotive Works.

The St. Louis & San Francisco Railway are having 100 freight cars built by the Missouri Car & Foundry Co., and 100 freight cars by the St. Charles Car Co.

The Schenectady Locomotive Works are engaged on an order for ten eight-wheel passenger engines for the New York Central & Hudson River Railroad.

There are three eight-wheel engines and one six-wheel connected engine under construction at the Baldwin Locomotive Works for the San Francisco & San Joaquin Valley Railway.

The Norfolk & Western Railway are building 250 freight cars at their shops, and are also having 250 built at the Milton Car Works, and 500 by the Ensign Manufacturing Company.

The Barney & Smith Car Company have received an order from the Cincinnati, Hamilton & Dayton for one baggage car, one vestibuled mail car, one combination mail and baggage car and one vestibuled mail and baggage car.

The Cleveland, Cincinnati, Chicago & St. Louis have placed the following orders: One sample consolidation freight engine from the Richmond Locomotive Works; from Barney & Smith Car Manufacturing Company, one dining car, two parlor cars and four express horse cars.

The Baldwin Locomotive Works received the following foreign orders last month: Ten passenger and twelve freight locomotives for the Finland State Railway; sixteen freight and eight passenger engines for the Central Railway of Brazil; ten freight engines for the Grand Trunk of Canada; one passenger engine for the Norwegian State Railway, and one rack engine for the Cia Penoles of Mexico.

The Schenectady twelve-wheelers recently built for the Butte, Anaconda & Pacific, and practically the same as the Northern Pacific locomotives illustrated in our March number, have been put to work, and are proving remarkably efficient in the hauling of heavy trains over steep grades. A local paper, describing a test of one of these engines, said it pulled thirty-three cars of ore, making a tonnage of 1,376 tons. This is a remarkable record, when it is considered that the grades from East Anaconda to Anaconda proper are taken into consideration. There is a rise of 64 feet to the mile, and there is one very hard double-reverse curve to pull the train over. The heaviest engines previously used on this part of the road could not possibly haul more than twenty cars of ore.

The Davis & Egan Machine Tool Co., of Cincinnati, have just been awarded a contract by the United States government for one 30-inch lathe, four 8x8 engine lathes, and eight 25-inch standard drill presses. This company has just shipped a car load of machine tools, consisting of hub machines, automatic screw machines, milling machines, and other tools adapted to the manufacture of bicycles, to London, England, where they will be exhibited at the Crystal Palace Bicycle Show.

One of the prettiest little memorandum books that we have seen for some time, issued by a railroad supply firm, has been sent out with the compliments of the American Steel Casting Company, Thurlow, Pa. The company wish to give the memorandum book to railroad men interested in steel castings. Those who have a legitimate right to the book should send for it, and they will find it a very convenient pocket companion.

Among recent orders received by the Chicago Pneumatic Tool Company are foreign orders for fifty-six machines, for hammers, drills and riveters. They have also received orders for eight hammers from Austria and 10 hammers from Great Britain. This company is putting considerable new machinery into the factory, but is yet compelled to run day and night to keep within sight of the business.

The Cincinnati, Hamilton & Dayton have increased their shop force considerably, in order to equip their freight cars with automatic couplers and air brakes, so that they may be able to make a good report by the time that the law relating to safety appliances goes into force.

Notes on Steel Working.

BY F. F. HEMENWAY.

No old blacksmith who has worked steel the better—or greater—part of his life ever imagines that he knows all that is known, or is to be known, about steel-working. He may have stored away in his head a good many cranky notions that nobody but himself believes in, which as much as anything indicates that after all the years in which steel has been fashioned and hardened and tempered by the artisan there is yet much to be learned about the whole matter.

In his search for definite knowledge the average steel-worker is generally handicapped. He is supplied with one brand until he begins to find out how to study its peculiarities, then he is supplied with something a good deal cheaper, and, of course, a good deal better, and so it is very likely to go with him; and even if the order goes for "just the same" it is not quite certain that it will be like the last lot. It ought, however, to be said that in this last respect there has been great improvement during the past few years. The difficulties of steel-makers in this respect, outside of producing a steel very nearly free from impurities, may be the more readily comprehended by a consideration of the fact that one firm of steel manufacturers classifies three grades thus: Carbon 0.20 to 0.35 per cent., hardened a little; carbon 0.35 to 0.50 per cent., may be hardened; carbon 0.50 to 0.65 per cent., may be strongly tempered. When a small fraction of one per cent. of carbon makes the difference indicated it is small wonder that steel varies a little when it comes to the verdict of those who use it. Again, one brand of steel may be quite equal to another if given different treatment in working. One may actually be benefited by working at a heat so high as to seriously injure another. The experienced steel-worker judges of this mainly upon its behavior while beginning to work it at a moderate heat, but he can no more explain in print how he does this than an engineer can explain to a professor how to make time over the road with two cars too many.

JUDGING QUALITY BY FRACTURE.

"Mighty good steel," the novice says when he sees a piece that shows a fine fracture when broken cold. Something, no doubt, may be told by the fracture of a bar of steel as its value for a specific purpose, but it requires an expert to judge very correctly. The old tool-dresser makes a tool from a bar that shows a comparatively coarse fracture and he gets a good tool. You cannot always tell much by the fracture.

PROPER HEAT FOR WORKING.

A good deal is written about hammering steel until cold. While, beyond question, steel should be worked at a comparatively low heat, it should not be forged cold. The heavy hammering and getting into form should be done at the highest heat, and as the piece gradually loses color the blows should be correspondingly lessened in intensity, until at the coolest they are planishing blows merely. That is, the general form of the tool, whatever that form may be, should be given it at the highest permissible heat. What that heat is varies, as has been intimated, with the quality of the steel being worked. The most that can be said of the proper heat for forging is that it is shown by a red that may be called dull in contrast with the bright, glistening red at which iron is worked. The individual judgment of the man who works the steel must determine the proper heat with reference to every brand of steel he uses.

HEAT SLOWLY.

The heating for forging (as well as for hardening) should be moderately slow—for large pieces almost immoderately slow—for the simple reason, and for no other, that slow heating gives the heat more time to distribute itself without local overheating, which is something that should be particularly avoided. Local over-heating is likely to develop into cracks in hardening, and frequently in tempering, and even hours afterwards. While the heating should be slow, the piece should by no means be allowed to lie and "soak" in the fire after it has come to the proper heat for working. Perhaps, probably, the small fraction of carbon that ought to be present to make the steel "just right" is lost by the soaking. However that may be, the steel is, beyond question, injured. When the piece is hot enough, hammer it gently.

RESTORING OVER-HEATED STEEL.

A good deal has been said, in one way or another, about "restoring" steel, at the forge, that has been over-heated in the working. Perhaps this may be done when it is to be used for some purposes, but for the purposes of a cutting tool, a piece of steel that has been burned is ruined. It *may* be benefited by the use of some of the various restoring compounds, but it cannot be restored. Even by heating and plunging into cold water, the looks of the fracture may be improved, perhaps it can be brought to look quite right, but I have yet to see a cutting tool made from a piece of steel that had been over-heated—burned—that I had any reason to believe was as good as if the over-heating had not occurred. When in forging any kind of a tool the end is accidentally over-heated, the only safe plan is to cut off that end a little beyond the over-heating—cut off a little more than has been burned—and deposit it in the scrap heap. The junkman may make something of it; there is every chance that a cutting tool that is satisfactory can never be made from it; it is certain that it cannot. If you are a tool forger, do not take any stock in restoring compounds, not for your own use. And I do not say that such compounds are humbugs, or anything of the kind, at that. The fracture may look all right after the restoring, but the fracture does not do the cutting. When a piece of steel out of which a cutting tool is to be made is burned, as much of it as is to do the cutting is ruined, for that purpose at least. Again, I am not saying a word against restoring compounds. They may be quite the proper thing for some purposes, but the only way to make a good cutting tool is not to burn the steel.

HARDENING AND TEMPERING.

No one knows exactly what occurs when a piece of steel is hardened. The whole matter is mainly one of speculation. It probably would not help matters vary materially if a good deal more were known about it. The most we know that is of practical utility is that if a piece of tool steel is heated to some kind of a red heat and then suddenly cooled, it will be put in a condition to cut; it will be "hardened," the degree of hardness depending, within certain limits, upon the temperature to which it has been heated and the rapidity with which it is cooled.

HARDENING OUTRIGHT.

It would probably be better if the piece being operated upon could be hardened outright—that is, heated to just the right temperature and cooled just quickly enough so that it would be of the temper required. This, however, is not practicable, except in comparatively rare instances. It would be better; for if, as is believed, hardening, so called, is a peculiar atomic arrangement, it is probable that the fewer times the atoms are disarranged and rearranged, after hammering, the better. And this view appears to be sustained—it is sustained—by the fact that softening and re-hardening a tool without intervening hammering soon destroys, or seriously impairs, its usefulness.

HEAT FOR HARDENING.

While, as has been said, it is not generally practicable to harden outright, the heating for hardening should be carried no further than is necessary to harden but little above the temper required. The lower the heat the less the atoms are disturbed by the heating for hardening, and by previous heating for tempering, when such heating is necessary. "Heat to a cherry red," is the common advice, which is, perhaps, as good as any, since the variation in the color of cherries is great enough to suit the most critical. Experience demonstrates that the fewer times steel is heated after being forged to shape, and the lower the heat (so that it serves the purpose), the better the tool that is produced.

FUEL FOR HEATING.

There is no better fuel for heating crucible steel than charcoal. But the scarcity of this fuel practically prohibits its use, except in favored localities. I do not believe that charcoal is the best fuel, because other fuel is likely to add something to or abstract something from the steel. I do not believe this is possible at any heat to which steel is, or should be heated in the blacksmith's fire. I believe charcoal to be the best of ordinary fuel, because it is probable that the heating will be more evenly done when it is used. Coked coal is a very good substitute for charcoal. In no case should a fresh coal fire be used for heating; not only is it so dirty that close observations of color cannot be readily made, but it burns in jets, resulting in local heating, which can hardly be avoided.

FOR COOLING.

For cooling to harden there is, for ordinary purposes, probably nothing better than just water. Water is variously "doctored" with salt, vitriol, etc., which will undoubtedly make the article a little harder, because it cools it quicker, and its use may sometimes be advisable where the hardening is to be outright, but, in my experience, never when the temper is to be drawn or "run down."

TEMPERING WITHOUT HAMMERING.

Many of us remember the time when it was not believed to be practicable to make a satisfactory cutting tool of any kind from a piece of steel as it came from the mill—that is, without a certain amount of hammering. However that may have been once, at the present time the best mills furnish stock for small tools that is not improved by heating or hammering till it comes to be heated for hardening, which is, generally, a matter of considerable convenience.

Altogether, the attainment of great skill in working steel as the blacksmith works it is an undertaking equal to anything in the arts. The very best of steel workers find, after years spent at it, that there is about as much to learn as there ever was, the most of which they will never be able to learn. Every improvement in steel making seems to call for corresponding improvement at the forge.

Piston Valves in Locomotives.

One of the most interesting papers read before the recent engineering conference in connection with the Institution of Civil Engineers was by Mr. S. W. Johnson, on "Piston Valves in Locomotives." The piston valve used on the Midland Railway, at each end contains three segments of hard gun metal and one ring of a softer metal. The segments are made from a ring, turned and then cut into three equal parts, the position of each being retained by a radial feather, which fits into a guiding recess formed on the end cap. The flexible ring abuts against the segments on the exhaust side, and closes the spaces left between them.

so that steam cannot escape into the exhaust chamber. To prevent the escape of steam into the cylinder through the spaces left between the segments, bridges are formed in the valve. Each segment, as is the case in the ordinary flat valve, is held against the face on which it works, by the pressure of steam in the chest acting on the back. The power to operate the piston valve is found to be only one-sixth of that required by the ordinary slide valve, and consequently the wear of the gear is much reduced. From results of engines with piston valves doing the same work, the wear per 100,000 miles is returned at about 6 to 1 in favor of the piston valves. A further advantage referred to is that the breaking of a slide valve usually disables an engine, but should a segment of the piston valve break, the broken portion would be held in position, and the engine need not cease working.—"The Mechanical World."

The Eccentric Question on the P. X. & Q. Road.

BY R. E. MARKS.

"Got something to show you, Mr. Duzenbury," said young Philpot, as he hauled a sketch out of his pocket. "You know what a trouble some of the men have been having with eccentrics; set screws get loose, and they work on the axle. Then, too, they sometimes open out and bind in the strap. Now, this reduces the number of parts to two for both eccentrics on a side, lessens the chance of working loose, and prevents any monkeying with 'a little more lead' after they are laid out in the drawing room, where they are supposed to be right, and are, near enough, I guess."

The sketch was almost identical with the latest practice of the Pennsylvania road, in casting both eccentrics of each side together, and having but two pieces instead of four. But Philpot had never seen it, and it was original with him.

"That's a good plan, Philpot," said Duzenbury, "being used on the 'Pensy' now; but now that you're talking about eccentrics, why not go to the end, and have them right?

"What causes most of the trouble with the eccentrics on this division? What laid the 'Bottle Green' out cold when we were trying to beat the Great Air Line special, the other day? Was it because the eccentric slipped on the shaft and changed the lead, or"——

"No," broke in Philpot, "'twas the confounded binding bolts working loose. I see what you're after—we can put lock nuts on the bolts and keep them tight. Might try the scheme Fred Rogers showed in the September 'Locomotive Engineering.'"

"Yes, that's a remedy for the disease, in a measure; but why not take the ounce of prevention, and make all eccentrics solid to begin with? then you wouldn't need anybody's scheme to prevent them getting loose," said Duzenbury.

"That's all right, Mr. Duzenbury; but how about repairs? Have to consider repairs, as well as first cost and arrangement. It's mighty easy to repair a two-part eccentric, but how about a solid one?" and Philpot winked the other eye and felt that he had Duzenbury "dead to rights," as the boys say. But John was loaded for bear; he had been thinking eccentrics himself lately.

"I knew you'd say that, Philpot; they always do, for I've tackled this before. Now, see here. How many eccentrics did you ever know to give trouble that wasn't due to the two parts loosening and binding in the strap? Some, of course; for if they run dry, they'll bind anyhow. But I'll bet you my last year's hat that most of them were from just this cause.

"Grant that, and you remove most of the trouble by making solid eccentrics and putting them in place before the wheel is pressed on.

"Now about breaks and repairs. When this does happen, which won't be over once in six months, you can smash the offending eccentric and replace it by a two-part affair, such as we use now. Then you'll have three good ones and only one makeshift (for that's all they are).

"I'm not sure, but I rather take a wheel off and put on a solid one, where there was time, though; for I believe it's cheaper in the end, and I might even go so far as to forge them on the axle when that was being made. They wouldn't slip, and they wouldn't spread, either; but I guess the solid cast-iron one will answer if they'll only let me use that.

"But keep on thinking, Philpot; you are on the right track, and if they won't let me use solid eccentrics, I'll advocate yours as next best, for I believe it is.

"I always go on the plan that the fewer pieces you use, and the simpler you can make anything, the better it is for all concerned. There are a few exceptions, possibly; but it's a safe general rule to follow."

I think Duzenbury is about right in this.

We have received Report of the Proceedings of the Fifth Annual Convention of the National Association of Master Blacksmiths, from the secretary, Mr. George F. Hinkens, of the St. Paul & Duluth, St. Paul, Minn. There is so little readable literature concerning the art of the backsmith that we are always glad to receive this little volume, and the latest report is one of the best sent out by the Blacksmiths' Association. It contains a great deal of valuable information about blacksmithing, which will be particularly interesting to foremen and others who take an interest in the details of the work. It can be obtained from the secretary for 50 cents.

The Bignall & Keeler Mfg. Co., Edwardsville, Illinois, report a lively demand for their Peerless and Duplex pipe threading and cutting machines. Their very recent sales are: Nelson, Morris & Co., St. Joseph, Mo., 2 machines; Armour & Co., South Omaha, Neb., 3; U. S. government, for new dredge boats, for Mississippi River Commission, 2; G. T. Reynolds, Cairo, Illinois; Ogden Gas Co., Chicago; National Tube Works, Chicago; Swift & Co., St. Joseph, Mo.; Wabash R. R. Co., Decatur, Illinois; W. S. Laycock, Sheffield, England.

Mr. Charles Parsons, receiver, has placed an order with the Schenectady Locomotive Works for three compound consolidation freight locomotives for the Ogdensburg & Lake Champlain Railroad, having cylinders 22 and 34 inches diameter and 28-inch stroke. The driving wheels are 54 inches in diameter, and the engines are to weigh 150,000 pounds. The engines are to be operated on the heavy grade between Moira and Rouse's Point. The engines are of the latest design, have steel driving wheels and all the modern improvements; cast and pressed steel being largely used in order to give the maximum size of boiler and bearings obtainable with the above weight. The boiler pressure is 200 pounds per square inch.

Mr. William C. Baker, inventor of the Baker car heater, has been so busy for some time that he has had to increase his shop force. In spite of all its rivals, the Baker heater seems to hold its popularity as a safe and comfortable way to warm cars.

A number of Chicago capitalists have purchased land at Lomax, Ill., for the purpose of building works for the construction of steel cars. The leaders are ambitious to get some experience with sociology in addition to car building, and they propose erecting a town similar to Pullman. We suspect they will get all the grief and experience they need before they get the steel car building plant in operation.

INDEX TO ADVERTISEMENTS.

Buyers' Finding List.

AIR BRAKE HOSE.
Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.
Peerless Rubber Mfg. Co., New York.

AIR BRAKES.
Westinghouse Air Brake Co., Pittsburg, Pa.

AIR COMPRESSORS.
Clayton Air Compressor Works, New York.
Ingersoll Sergeant Drill Co., N. Y. City.
Norwalk Iron Works Co., South Norwalk, Ct.
Pedrick & Ayer Co., Philadelphia, Pa.
Rand Drill Co., New York.

AIR LIFT PUMPS.
Clayton Air Compressor Works, New York.

AIR LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa.

AIR PUMP GOVERNORS.
Mason Regulator Co., Boston, Mass.

ARCH BARS.
Cambria Iron Co., Philadelphia, Pa.

ASBESTOS.
Carey Mfg. Co., Philip, Lockland, O.

AXLES.
Cambria Iron Co., Philadelphia, Pa.

BALANCED SLIDE VALVES.
Am. Bal. Slide Valve Co., San Francisco, Cal.
M. C. Hammett, Troy, N. Y.

BEARING METAL.
Ajax Metal Co., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

BELL RINGER.
U. S. Metallic Packing Co., Philadelphia, Pa.

BELTING.
Peerless Rubber Mfg. Co., New York.

BENDING MACHINES.
Long & Allstatter Co., Hamilton, O.

BOILER AND FIREBOX STEEL.
Shoenberger Steel Co., Pittsburg, Pa.

BOILER COVERINGS.
Carey Mfg. Co., Philip, Lockland, O.
Keasbey & Mattison Co., Ambler, Pa.

BOILERS.
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Locomotive & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa.
Pittsburg Locomotive Works, Pittsburg, Pa.
Richmond Loco. & Mach. W'ks., Richmond, Va.

BOILER TUBES, LOCOMOTIVE.
Allison Mfg. Co., Philadelphia, Pa.
Tyler Tube & Pipe Co., New York.

BOLT THREADING MACHINERY.
Acme Machinery Co., Cleveland, O.
Manning, Maxwell & Moore, New York.

BOOKS.
Arnold Publishing House, New York.
Audel & Co., New York.
Griffin & Winters, Chicago, Ill.
H. C. Baird & Co., Philadelphia, Pa.
Railroad Gazette, New York.
Practical Publishing Co., East Orange, N. J.

BORING MACHINES.
Manning, Maxwell & Moore, New York.
Niles Tool Works Co., Hamilton, O.

BRAKE ADJUSTERS.
Q. & C. Co., Chicago, Ill.

BRAKE SHOES.
Ramapo Iron Works, Hillburn, N. Y.
The Sargent Co., Chicago, Ill.

BRASS CASTINGS.
Ajax Metal Co., Inc., Philadelphia, Pa.
Paul S. Reeves, Philadelphia, Pa.

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Gould Coupler Co., Buffalo, N. Y.

BULLDOZERS.
Williams, White & Co., Moline, Ill.

CAB SEATS.
Stannard & White, Appleton, Wis.

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Lima Locomotive & Machine Co., Lima, O.

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Gould Coupler Co., Buffalo, N. Y.
Latrobe Steel Co., Philadelphia, Pa.
McConway & Torley Co., Pittsburg, Pa.
National Malleable Castings Co., Chicago, Ill.
Smillie Coupler & Mfg. Co., Newark, N. J.
Standard Coupler Co., New York.
Trojan Car Coupler Co., Troy, N. Y.

(*Continued on page 933.*)

BUYERS' FINDING LIST—*Continued.*

CAR DOOR FASTENERS.
National Malleable Castings Co., Chicago, Ill.

CAR FORGINGS.
Dickson Mfg. Co., Scranton, Pa.

CARS, FREIGHT.
Allison Mfg. Co., Philadelphia, Pa.

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Safety Car Heating & Lighting Co., New York.

CAR HEATING HOSE.
N. Y. Belting & Packing Co., New York.
Boston Belting Co., Boston, Mass.

CAR LIGHTING.
Safety Car Heating & Lighting Co., New York.

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Drake & Weirs, Cleveland, O.
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CATTLE GUARDS.
Q. & C. Co., Chicago, Ill.

CHANNELERS.
Ingersoll-Sergeant Drill Co., New York.

CHIME WHISTLES.
Crosby Steam Gage & Valve Co., Boston, Mass.
Star Brass Mfg. Co., Boston, Mass.

CIGARS.
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COAL HANDLING MACHINERY.
Link Belt Engineering Co., Philadelphia, Pa.

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Dickson Mfg. Co., Scranton, Pa.

CONVEYORS.
Link Belt Engineering Co., Philadelphia, Pa.

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Cambria Iron Co., Philadelphia, Pa.

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Stow Flexible Shaft Co., Philadelphia, Pa.

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Moran Flexible Steam Joint Co., Louisville, Ky.

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Tyler Tube & Pipe Co., Washington, Pa.

FORGES.
The Bradley Co., Syracuse, N. Y.

FORGINGS.
Bethlehem Iron Co., So. Bethlehem, Pa.
Brooks Locomotive Works, Dunkirk, N. Y.
Richmond Loco. & Mch. Wks., Richmond, Va.

(*Continued on page 934.*)

BUYERS' FINDING LIST—*Continued.*

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GEAR CUTTERS.
Gould & Eberhardt, Newark, N. J.

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Jos. Dixon Crucible Co., Jersey City, N. J.

HAMMERS.
Bradley Co., The. Syracuse, N. Y.
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Buffalo Forge Co.

HOISTS, PNEUMATIC.
Chicago Pneumatic Tool Co , Chicago, Ill.
Pedrick & Ayer Co., Philadelphia, Pa.

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Falls Hollow Staybolt Co., Cuyahoga Falls, O

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Watson & Stillman, New York.

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Chapman Jack Co., Cleveland, O.

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Lodge & Shipley Mch. Tool Co., Cincinnati, O
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Niles Tool Works Co., Hamilton, O.
Pratt & Whitney Co., Hartford, Conn.

LOCOMOTIVE, LOGGING.
Brooks Locomotive Works, Dunkirk, N. Y.

LOCOMOTIVES.
Baldwin Locomotive Works, Philadelphia, Pa
Brooks Locomotive Works, Dunkirk, N. Y.
Cooke Loco. & Machine Co., Paterson, N. J.
Dickson Mfg. Co., Scranton, Pa.
Lima Locomotive & Machine Co., Lima, O.
Pittsburg Locomotive Works, Pittsburg, Pa.
H. K. Porter & Co., Pittsburg, Pa.
Richmond Loco. & Mch. Wks., Richmond, Va.
Rogers Locomotive Works, Paterson, N. J.
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McConway & Torley Co., Pittsburg, Pa.
S. J. Meeker, Newark, N. J.
National Malleable Castings Co., Chicago, Ill

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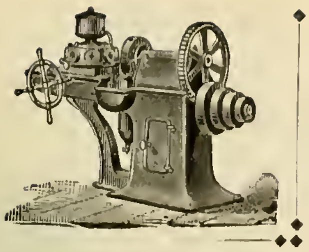
Dickson Mfg. Co., Scranton, Pa.

MODEL LOCOMOTIVES.
Olney & Warren, New York.

MOLDING MACHINES.
Tabor Mfg. Co., Elizabeth, N. J.

(Continued on page 935.)



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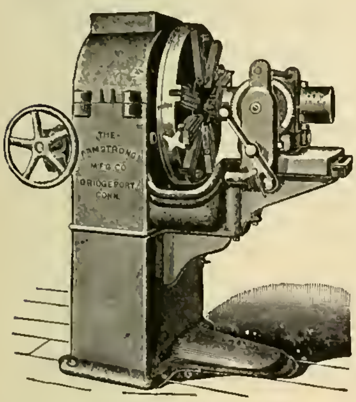

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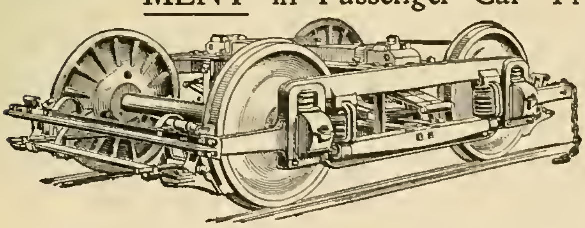

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Star Brass Mfg. Co., Boston, Mass.

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Sherburne & Co., Boston, Mass.
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Western Railway Equipment Co., St. Louis, Mo.

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India Alkali Works, Boston, Mass.

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International Correspondence School, Scranton, Pa.

SHAPERS.
Bement, Miles & Co., Philadelphia, Pa.
Gould & Eberhardt, Newark, N. J.
Pratt & Whitney Co., Hartford, Conn.

(Continued on page 936.)

BUYERS' FINDING LIST—*Continued.*

SLOTTERS.
Bement, Miles & Co., Philadelphia, Pa.

SOAP, LAVA.
Wm. Waltke, St. Louis, Mo.

SPACING TABLE.
Long & Allstatter Co., Hamilton O.

SPARK ARRESTER PLATE.
Hendrick Mfg. Co., Carbondale, Pa.

SPRINGS.
A. French Spring Co., Pittsburg, Pa.

STAMPS, STEEL.
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STAYBOLT IRON.
Falls Hollow Staybolt Co., Cuyahoga Falls, O.

STAYBOLT TAPS.
S. W. Card Mfg. Co., Mansfield, Mass.

STEAM GAGES.
Star Brass Mfg. Co., Boston, Mass.
Utica Steam Gage Co., Utica, N. Y.

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Boston Belting Co., Boston, Mass.
N. Y. Belting & Packing Co., New York.

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Latrobe Steel Co., Latrobe, Pa.
Shoenberger Steel Co., Pittsburg, Pa.

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Standard Steel Works, Philadelphia, Pa.
Steel Tired Wheel Co., New York.

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Latrobe Steel Works, Latrobe, Pa.
Krupp (T. Prosser & Son, New York).
Standard Steel Works, Philadelphia, Pa.

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Ramapo Iron Works, Hillburn, N. Y.

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Morse Twist Drill & Mch. Co., New Bedford, Mass.

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Jenkins Bros., New York.
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Mason Regulator Co., Boston, Mass.
Ross Valve Co., Troy, N. Y.

VALVE SEAT PLANERS.
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Long & Allstatter Co., Hamilton, O.

WHEEL PRESSES.
Manning, Maxwell & Moore, New York

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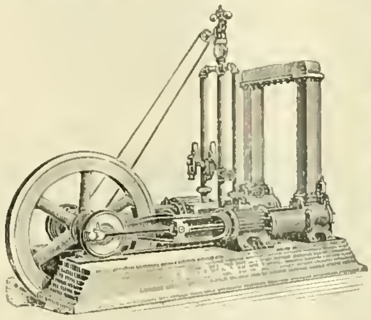

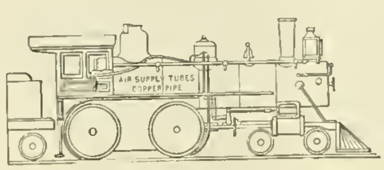

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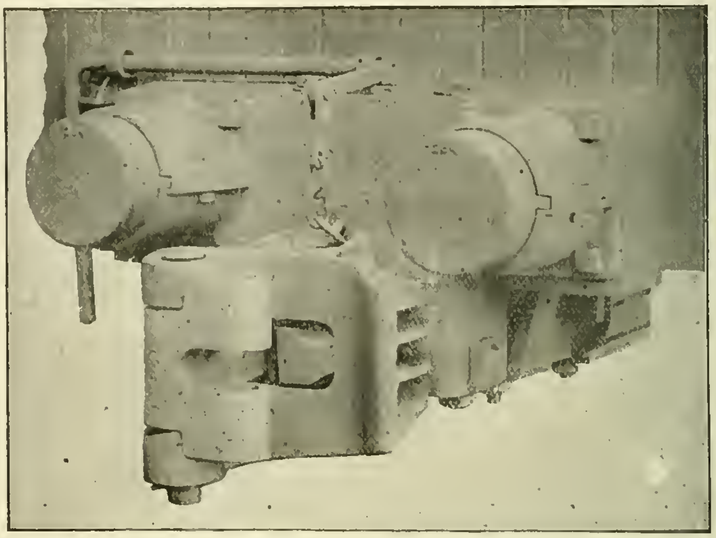

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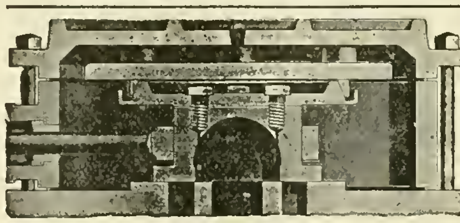

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